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VoltaGrid LLC

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Washington Department of Ecology

Prepared by

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REVISED NOTICE OF CONSTRUCTION APPLICATION FOR A 30 MW POWER PLANT

VOLTAGRID LLC

GRANT COUNTY PUBLIC UTILITY DISTRICT

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ACRONYMS AND ABBREVIATIONS

ASIL:	Acceptable Source Impact Level
BACT:	Best Available Control Technology
CAA:	Clean Air Act
CCS:	Carbon Capture & Sequestration
CFR:	Code of Federal Regulations
CH_4:	Methane
CNG:	Compressed natural gas
CO:	Carbon Monoxide
CO_2:	Carbon Dioxide
EGU:	Electric Generating Unit
FGR:	Flue Gas Recirculation
GCP:	Good Combustion Practices
GHG:	Greenhouse Gas
HAP:	Hazardous Air Pollutant
Hr:	Hour
ICE:	Internal Combustion Engine
IGCC:	Integrated Gasification Combined Cycle
Lb:	Pounds
LLC:	Limited Liability Corporation
MACT:	Maximum Achievable Control Technology
MMBtu:	Million British Thermal Units
MW:	Megawatt
NAAQS:	National Ambient Air Quality Standards
NAICS:	North American Industrial Classification System
NESHAP:	National Emission Standards for Hazardous Air Pollutants
NSCR:	Non-selective Catalytic Reduction
NSPS:	New Source Performance Standards
NSR:	New Source Review
NOC:	Notice of Construction
NO_X:	Nitrogen Oxides
N_2O:	Nitrous Oxide
OFA:	Overfire Air
PSD:	Prevention of Significant Deterioration
PTE:	Potential to Emit
RICE:	Reciprocating Internal Combustion Engine
RMP:	Risk Management Plan
SCR:	Selective Catalytic Reduction
SI:	Spark Ignition
SIC:	Standard Industrial Classification
SO_X:	Sulfur Oxides
SQER:	Small Quantity Emission Rate
TAP:	Toxic Air Pollutant
tpy:	Short Tons Per Year
USEPA:	United States Environmental Protection Agency
VMT:	Vehicle Mile Traveled
VOC:	Volatile Organic Compounds
WAC:	Washington Administrative Code

1. INTRODUCTION

VoltaGrid LLC (VoltaGrid) is proposing to construct a baseload power facility with a maximum power output of 30 megawatts (MW) consisting of 14 trailer-mounted Jenbacher J620 natural gas-fired four-stroke lean-burn reciprocating internal combustion engines (RICE) ("the Facility"). The Facility is a baseload facility that is proposed to operate for 8,760 hours per year.

In addition to the 14 J620 RICE units, the Facility will also have one (1) natural gas-fired black start emergency engine generator.

The Facility is proposed to provide prime power to the Vantage Data Centers Management Company, LLC (VDC) data center campus, located at 2101 M Street NE, Quincy, Washington ("the data center"). Prime power for the data center is currently supplied by the Grant County Public Utility District (GCPUD), and backup, emergency power for the data center is supported by sixty-one (61) diesel-fired emergency generators (authorized under VDC's Approval Order 23AQ-E056, dated August 29, 2023). GCPUD and VDC are anticipating a short-term shortfall of prime power to the data center due to regional power supply limitations.

Construction of the Facility would fulfill an immediate need for alternative, rapidly deployable prime power to supplement the regional prime power deficit. To that end, Ramboll Americas Engineering Solutions, Inc. (Ramboll), on behalf of VoltaGrid, has prepared this revised Notice of Construction (NOC) application to obtain a minor source Order of Approval under Washington Administrative Code (WAC) Section 173-400-110. The Facility owner, operator and permit holder will be VoltaGrid. The land on which the Facility is proposed to be constructed is owned by GCPUD.

2. PROCESS DESCRIPTION

2.1 Facility General Information

The Facility will be constructed adjacent to the Quincy Foothills Substation at the northwest corner of Road 0 NW and Road 11 NW in Quincy, Washington. The Facility will be constructed on property owned by GCPUD. Refer to **Figure 1** for the site location.

The operations of the Facility are categorized under North American Industrial Classification System (NAICS) 221112: Fossil Fuel Electric Power Generation, Standard Industrial Classification (SIC) Code 4911: Electric Services.

2.2 J620 RICE Units

2.2.1 Equipment Description

As noted previously, the proposed Facility will consist of 14 trailer-mounted Jenbacher J620 natural gas-fired four-stroke lean-burn RICE units. Each RICE will be equipped with combustion exhaust treatment provided by Hug Engineering. Emissions from each RICE will be released from a 2-foot diameter vertical stack approximately 34 feet above grade.

Compressed natural gas (CNG) will be transported to the Facility via semi-tractor trailers. CNG from the tractor trailers will be decompressed through a pressure reduction skid (PRS), then distributed to each RICE as fuel.

A portion of the power generated by the RICEs will connect to an on-site generator, which will power ancillary on-site equipment through a switchgear. Each RICE will be structured and operated to augment the prime power shortfall of the region by providing prime power to the data center campus operated by VDC. Power generated by the Facility will be connected to the Quincy Foothills Substation for distribution to the data center. A detailed site layout of the Facility, as well as a process flow diagram for both engine types, can be found in **Figure 2** and **Figure 3**, respectively.

2.2.2 Air Pollution Control Information

Each RICE will be equipped with an add-on combustion exhaust treatment system known as CombiKat™. The CombiKat™ consists of a selective catalytic reduction (SCR) system and an oxidation catalyst. For SCR control, the system will be fed with a 32.5% urea solution to be stored in bulk tanks at the Facility. The urea solution is injected into the combustion exhaust gas prior to the SCR bed to aid in the reduction of oxides of nitrogen (NO_X) in the stack. The oxidation catalyst will control emissions of carbon monoxide (CO) and volatile organic compounds (VOCs), where gaseous toxic air pollutant (TAP) emissions will be controlled by the oxidation catalyst. Details on emission factors and facility-wide potential-to-emit (PTE) calculations are provided in **Appendix C**. The emissions from the Facility will satisfy Best Available Control Technology (BACT) for this equipment type, as demonstrated in **Appendix E**.

2.3 One (1) Natural Gas-Fired Black Start Emergency Engine

The Facility will also include one (1) natural gas-fired black start engine. The engine is required to provide emergency power to start the auxiliary systems to power the first J620 engine post a black out event. The emergency engine will be permitted to operate for 100 hours/year for maintenance and testing. Emissions from the black start emergency engine will be released from two 4-inch diameter vertical stacks at approximately 10.4 feet

above grade. The black start emergency engine will have an SCR and an oxidation catalyst to control emissions.

2.4 Unpaved Roads

The Facility will have graveled (unpaved) roads for the CNG trucks to traverse. In addition to the CNG trucks, there will be several pickup trucks driving around the Facility for equipment checks and maintenance purposes. Per VoltaGrid's estimates, each CNG truck is expected to travel 0.30 miles per trip for a total of 0.60 miles per roundtrip. Similarly, each pickup truck is expected to travel 0.30 miles per trip for a total of 0.60 miles per roundtrip. The empty weight of the CNG truck is 30 tons and the loaded, full weight is 39 tons. The pickup truck is conservatively estimated to weigh 4.3 tons.

3. EMISSION ESTIMATES

3.1 Methodology

This section outlines the emissions from the natural gas engines of generators, which produce electricity via an alternator that doesn't emit pollutants. State and federal regulations apply solely to these engine emissions, and "generator" and "engine" are used interchangeably in the report. Pollutants emitted from the J620 engines and the black start engine will include NO_X, consisting of nitrogen dioxide (NO_2) and nitric oxide (NO); CO; VOC; sulfur dioxide (SO_2); particulate matter (PM), including PM_{10} and $PM_{2.5}$; TAP; and greenhouse gases (GHG) in units of carbon dioxide equivalent (CO_2e).

The methodology used to estimate the potential emissions from each source is discussed in the sections below. The manufacturer's specification sheets for the engines are provided in **Appendix D**, and detailed emissions calculations are provided in **Appendix C**.

3.2 J620 RICE Units - Methodology

Criteria Air Pollutants

The engine-specific emission factors provided by the manufacturer for NO_X, VOC (hydrocarbons), CO, filterable PM, and SO_2 were used to estimate the emissions of those pollutants for the engines under different operating conditions including steady state operations and startup periods. During startup periods (discussed further in **Section 3.2**), conservatively assumed to last 20 minutes, the control efficiency of the SCR and oxidation catalyst was conservatively assumed to be 0%. While the calculations conservatively assume 0% control during the entire startup duration, the oxidation catalyst (which is a passive control device) will begin oxidizing organics and CO as the engine exhaust heats up the catalyst bed (well before the end of the 20 min startup period).

During normal operations, the control efficiency is 98% for the SCR for NO_X control, 95% for the oxidation catalyst for CO and VOC control based on manufacturer specifications.

Greenhouse Gas Pollutants

The GHG emission factors provided in 40 CFR 98 Subpart C, Tables C-1 and C-2 were used to estimate emissions of carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O). Emissions GHGs as carbon dioxide equivalents (CO_2e) were calculated based on the global warming potentials provided in 40 CFR 98 Subpart A, Table A-1.

Toxic Air Pollutants

During startup operations, the emissions of NOx, CO, VOC and organic air toxics are assumed to be uncontrolled. The TAP emission factors provided in AP-42 Chapter 3.2-2 as well as in the California Air Toxics Emission Factors (CATEF) database were used to estimate uncontrolled emissions from 4-stroke lean-burn natural gas-fired RICEs. The greater emissions value between the two available datasets was used to conservatively estimate TAP emissions for a given TAP. During steady state operations, the calculations conservatively assumed that the oxidation catalyst offers a 90% control of organic TAPs.

Additional TAP emissions will result from operation of the SCR, where unreacted ammonia will be emitted as ammonia slip. Manufacturer guarantees were used to estimate emissions of ammonia at the engine stack. Manufacturer-guaranteed ammonia slip level of 5 parts per million by volume (ppmv) will be upheld through optimal operation of the SCR.

3.2.1 Startup Emissions

Based on operational experience at other sites, VoltaGrid estimates that there will be three (3) startup events for each engine every month, with each startup event lasting up to 5 minutes. While the thermal heat-up and the control efficacy will ramp-up during the (up to) 5 minute startup event, the calculations conservatively assume a 0% control efficiency for the entire startup period of 5 minutes.

As such, up to 0.25 hour per month (3 events/month/engine x 5 minutes/event) and 3 hours per year will be spent in startup for each engine. During startup, the catalyst-based control devices (SCR and oxidation catalyst) will require time to reach the operational temperature range needed to optimally control emissions of NO_X, CO, and VOC (including organic TAPs). Therefore, it is conservatively assumed that 3 hours per engine per year result in uncontrolled emissions, and 8,757 hours per engine per year are controlled emissions.

3.3 Black Start Emergency Engine - Methodology

Criteria Air Pollutants

The engine-specific, controlled emission factors provided by the manufacturer for NO_X, VOC, and CO were used to estimate the emissions of those pollutants for the black start emergency engine. Emissions of filterable and condensable PM, and SO_2 were based on emissions factors available in AP-42 Table 3.2-3 (Uncontrolled Emission Factors for 4-Stroke Rich-Burn Engines). Annual emissions were calculated based on an annual operating rate of 100 hours/year.

Greenhouse Gas Pollutants

The GHG emission factors provided in 40 CFR 98 Subpart C, Tables C-1 and C-2 were used to estimate emissions of CO_2, CH_4, and N_2O. The emission factors were converted from kg/MMBtu to lb/MMBtu. Emissions of GHGs as CO_2e were calculated based on the global warming potentials provided in 40 CFR 98, Subpart A, Table A-1.

Toxic Air Pollutants

The CATEF database does not provide TAP emission factors for 4-stroke rich-burn natural gas-fired RICE with a firing rate greater than 650 hp. Therefore, the TAP emission factors provided in AP-42 Table 3.2-3 were used to estimate uncontrolled emissions from the black start engine.

3.4 Unpaved Roads – Methodology

Criteria Air Pollutants

Unpaved roads are a source of particulate emissions (PM / PM_{10} / $PM_{2.5}$). Emissions of particulate emissions were estimated using AP-42 Section 13.2.2 Equation 1a.

$$E = k \left(\frac{s}{12}\right)^a \left(\frac{W}{3}\right)^b$$

where:

k = particle size multiplier;
E = size-specific emission factor (lb/Vehicle Miles Traveled);
s = surface material silt content (% passing 200-mesh, ASTM C136);
W = mean vehicle weight (tons).

After computing E (lb/VMT), multiply by the traffic (VMT/day or VMT/yr) to get mass emissions, and then account for natural precipitation by applying Equation 2 to produce an annualized factor:

$E_{ext} = E \cdot [(365 - P)/365]$

Where, P is the number of days per year with ≥0.01 in precipitation.

VoltaGrid proposes to implement annual surfactant application which results in 84% control of the fugitive PM emissions. The potential annual emissions from plant roads are below the exemption levels in WAC 173-400-110(5) and are therefore, exempt from permitting and dispersion modeling.

4. REGULATORY APPLICABILITY

The Facility is subject to federal and state regulations. The following subsections discuss the applicable regulations and why certain regulatory programs are not applicable. It should be noted that the Facility will be located in an area that is in attainment of all ambient air quality standards.

4.1 Major New Source Review (40 CFR 52.21 and WAC 400-720)

The New Source Review (NSR) preconstruction permitting program is an element of air quality regulations for maintaining attainment with the National Ambient Air Quality Standards (NAAQS) established by the United States Environmental Protection Agency (USEPA) for criteria pollutants. Under the federal Clean Air Act (CAA) and implementing state permitting programs, NSR preconstruction permitting is divided into two programs, which apply on a pollutant-specific basis as determined by the air quality of the area. In areas that are designated by the USEPA as "in attainment" or "unclassifiable" with regard to a NAAQS, the construction of a new major source is subject to the Prevention of Significant Deterioration (PSD) NSR program for the attainment pollutants regulated by that NAAQS. In areas that are designated "nonattainment" with regard to a NAAQS, the construction of a new major source is subject to review under the Nonattainment New Source Review (NNSR) program for the specific nonattainment pollutants.

VoltaGrid understands that the 30 MW power generation facility does not meet the definitions for any of the 28 listed categories in 40 CFR 52.21(b)(1)(i)(A) and adopted by reference in WAC 173-400-710. As such, the Facility will be subject to the 250 tpy major source threshold (40 CFR 52.21(b)(1)(i)(B)). That is, the Facility will be classified as a major stationary source if the PTE of any NSR-regulated pollutant (other than greenhouse gases) is 250 tons per year (tpy) or more. As presented in Section 3, PTE of each regulated pollutant is well below this threshold and PSD NSR requirements do not apply.

4.2 Minor New Source Review (WAC 173-400)

Washington requires new or modified industrial sources to obtain an NOC air quality permit. The NOC permit application must provide a description of the Facility, an inventory of pollutant emissions, and proposed control systems for the applicable pollutants. The reviewing agency considers whether BACT has been employed and evaluates ambient concentrations resulting from these emissions to ensure compliance with ambient air quality standards. As stated in WAC 173-400-113, an NOC permit cannot be granted unless the agency determines the project: 1) will meet applicable state and federal emission limits; 2) will employ BACT; 3) will not cause or contribute to violations of ambient air quality standards; and 4) will meet all applicable requirements of the TAP program in Chapter 173-460 WAC. This report provides the information to enable the Washington State Department of Ecology (Ecology) to make those determinations.

Washington regulations require that new sources or modifications of existing sources employ BACT for all air pollutants not previously emitted, or whose emissions would increase as a result of the new source or modification. The BACT analysis evaluates the energy, environmental, economic, and other costs associated with each technically feasible emission reduction alternative and weighs those costs against the reduced emissions each alternative would provide. Regulations also require a demonstration of compliance with the applicable air quality standards, which is typically accomplished through an air dispersion modeling

analysis. The modeling analysis methodology and results are provided in Section 4 of this report.

Table 4-1 below identifies additional equipment to be installed as part of the Facility that is not subject to the NOC process and provides justification for the exemption.

Table 4-1 Summary of NOC-Exempt Equipment

Equipment Description	Justification / Basis for Not Being Subject to NOC Process
Urea storage tanks	WAC 173-400-110 (4)(b)(viii): Tanks, vessels and pumping equipment, with lids or other appropriate closure for storage or dispensing of aqueous solutions of inorganic salts, bases and acids
Natural gas trailers	WAC 173-400-110 (6): Portable source with order of approval
Natural gas piping and depressurization	WAC 173-400-110 (4)(h)(xxxii): Natural gas pressure regulator vents, excluding venting at oil and gas production facilities and transportation marketing facilities
Heating, Ventilation, and Air Conditioning (HVAC)	WAC 173-400-110 (4)(h)(iv): Comfort air conditioning (no fuel fired heaters are expected to be used at this Facility)

This application describes all of the units (emitting and non-emitting) and presents the necessary pre-construction assessment for those emitting units not covered by an exemption.

4.3 New Source Performance Standards (40 CFR 60 and WAC 400-115)

New Source Performance Standards (NSPS), promulgated in 40 CFR 60 and adopted by reference in WAC 400-115, provide emissions standards for criteria pollutant emissions from new, modified, and reconstructed sources. The following sections discuss the NSPS that are potentially applicable to the proposed project.

4.3.1 NSPS Subpart A – General Provisions

NSPS Subpart A provides generally applicable requirements for testing, monitoring, notifications and recordkeeping. Any source that is subject to another subpart under 40 CFR 60 is also subject to Subpart A, unless otherwise stated in the specific subpart. Since the proposed facility will be subject to an NSPS (discussed later in this section), the proposed project will be required to comply with applicable provisions of Subpart A.

Table 4-2 40 CFR 60 Subpart A Requirements	
40 CFR 60 Subpart A Section	**Requirement**
60.7	Initial notification and recordkeeping
60.8	Performance Tests
60.11	Compliance with standards and maintenance requirements
60.13	Monitoring requirements
60.19	General notification and reporting requirements

4.3.2 NSPS Subpart JJJJ – Stationary Spark Ignition Internal Combustion Engines

NSPS Subpart JJJJ applies to new, modified, and reconstructed spark ignition (SI) internal combustion engines (ICE). New engines with engine power greater than 19 kW are subject to this regulation if construction of the SI ICE commenced after June 12, 2006, and if the engine was manufactured on or after July 1, 2007 for engines with a maximum engine power greater than or equal to 500 horsepower (hp) or on after January 1, 2009 for emergency engines with a maximum engine power greater than 19 kW (25 hp). Ramboll has assumed the model year of the proposed engines will be 2009 or later, and therefore this rule is applicable to the proposed SI ICE that will be operated at the Facility.

4.3.2.1 Primary J620 Engines

Emissions Standards

The proposed natural gas-fired generators will be classified as non-emergency generators under this regulation and will have an engine power rating of greater than 75 kW. Per 40 CFR §60.4233(e), the generators will be subject to the applicable emission standards in Table 1 of NSPS Subpart JJJJ. The applicable emission standards are summarized in **Table 4-3.**

Table 4-3 NSPS Subpart JJJJ Emissions Standards – Non-Emergency SI Natural Gas (HP≥500)		
Pollutant	**g/HP-hr**	**ppmvd at 15% O_2**
NO_X	1.0	82
CO	2.0	270
VOC	0.7	60
Source: Table 1 to Subpart JJJJ of Part 60		

The Facility will need to comply with the emission standards above by purchasing an engine certified by the manufacturer to comply with the emission standards. Further, the site will be required to operate and maintain the engine according to the manufacturer's emission-related written instructions and only change those emission-related settings that are permitted by the manufacturer. Records of conducted maintenance must be maintained

on site to demonstrate compliance. The engine must be operated and maintained so that these emissions standards are achieved over the entire life of the engine.

Fuel Requirements

Fuel requirements under this subsection are only applicable to engines burning gasoline. The potential SI ICEs at the Facility will only burn natural gas and therefore this section is not applicable.

Notifications, Reporting, and Recordkeeping

An Initial Notification under NSPS Subpart A is not required for stationary ICE that are certified to meet the standards of 40 CFR § 60.4231. The Facility is required to keep records of all notifications submitted, all maintenance performed on the engine, and documentation from the manufacturer that the engine is certified. Additionally, the proposed engines will not use propane as an alternative fuel, so no testing is required.

4.3.2.2 Black Start Engine

Emissions Standards

The proposed black start engine will be classified as an emergency generator under this regulation and will have an engine power rating greater than 75 kW. Per 40 CFR §60.4233(e), the generator will be subject to the applicable emission standards in Table 1 of NSPS Subpart JJJJ. The applicable emission standards are summarized in **Table 4-4**.

Table 4-4 NSPS Subpart JJJJ Emissions Standards – Emergency SI Natural Gas (HP≥130)

Pollutant	g/HP-hr	ppmvd at 15% O_2
NO_X	2.0	160
CO	4.0	540
VOC	1.0	86
Source: Table 1 to Subpart JJJJ of Part 60		

The Facility will comply with the emission standards above by purchasing an engine certified by the manufacturer to comply with these emission standards. Further, VoltaGrid will operate and maintain the engine according to the manufacturer's emission-related written instructions and only change those emission-related settings that are permitted by the manufacturer. Records of conducted maintenance must be maintained on site to demonstrate compliance. The engine must be operated and maintained so that these emissions standards are achieved over the entire life of the engine. Emergency engines are also required to be equipped with a non-resettable hour meter (§60.4243(d) & (e)) to track hours of operation for maintenance and testing, for emergencies and non-emergency use.

Fuel Requirements

Fuel requirements under this subsection are only applicable to engines burning gasoline. The potential SI ICE at the Facility will only burn natural gas and therefore this section is not applicable.

Notifications, Reporting, and Recordkeeping

An Initial Notification under NSPS Subpart A is not required for stationary ICE that are certified to meet the standards of 40 CFR § 60.4231. The Facility is required to keep records of hours of operation for maintenance and testing, for emergencies and non-emergency use. Additionally, VoltaGrid must keep records of all notifications submitted, all maintenance performed on the engine, and documentation from the manufacturer that the engine is certified. Additionally, the proposed engine will not use propane as an alternative fuel, so no testing is required.

4.3.3 NSPS Subpart TTTT and TTTTa

Pursuant to 40 CFR 60.5508, Subpart TTTT establishes emission standards and compliance schedules for the control of GHG emissions from a stationary combustion turbine that commences construction after January 8, 2014, but on or before May 23, 2023, or commences reconstruction after June 18, 2014, but on or before May 23, 2023.

Pursuant to 40 CFR 60.5509a, NSPS Subpart TTTTa establishes emission standards for the control of greenhouse gas emissions from a coal-fired steam generating unit or integrated gasification combined cycle facility (IGCC) that commences modification after May 23, 2023. This subpart also establishes emission standards and compliance schedules for the control of greenhouse gas emissions from a stationary combustion turbine that commences construction or reconstruction after May 23, 2023.

Both Subpart TTTT and TTTTa apply to either IGCC units or combustion turbines. As part of the project, VoltaGrid proposes to install reciprocating internal combustion engines and not combustion turbines or IGCC units. As such, the project and its units are not subject to NSPS Subpart TTTT or to Subpart TTTTa.

4.4 National Emissions Standards for Hazardous Air Pollutants (40 CFR 61 and 63 and WAC 400-075)

The National Emissions Standards for Hazardous Air Pollutants (NESHAP) promulgated in 40 CFR 61 and adopted by reference in WAC 400-075, are stationary source standards for HAPs from specific source categories. The proposed project is not subject to any NESHAP under 40 CFR Part 61.

NESHAPs for Source Categories, promulgated in 40 CFR 63 and adopted by reference in WAC 400-075, regulate emissions of HAPs from specific source categories. NESHAP set the maximum available control technology (MACT) standards for major sources of HAP. A facility that has potential emissions exceeding 10 tpy for any individual HAP and/or emissions exceeding 25 tpy for the sum of all HAPs is classified as a major source of HAP emissions. A facility that is not a major source of HAPs is classified as an area source. The proposed facility is an area source of HAPs. The following sections discuss the potentially applicable NESHAP standards to the proposed facility.

4.4.1 NESHAP Subpart A

NESHAP Subpart A provides generally applicable requirements for testing, monitoring, notifications and recordkeeping. Any source that is subject to another subpart under 40 CFR §63 is also subject to Subpart A, unless otherwise stated in the specific subpart.

4.4.2 NESHAP Subpart ZZZZ

NESHAP Subpart ZZZZ applies to new and existing stationary RICE located at both major and area sources of HAP emissions. Per 40 CFR 63.6590(c), for new or reconstructed stationary RICE located at an area source of HAP emissions, the only requirement under NESHAP Subpart ZZZZ is to meet the requirements of NSPS Subpart IIII for compression ignition ICE and of NSPS Subpart JJJJ for SI ICE. Since the proposed SI ICE at the Facility will be in compliance with NSPS Subpart JJJJ, the units will also be in compliance with NESHAP Subpart ZZZZ. No further requirements apply for these engines under this regulation.

4.5 Compliance Assurance Monitoring (40 CFR 64)

Pursuant to 40 CFR 64.2(a), the provisions of 40 CFR 64 (CAM) are applicable to emission units that:

1. are subject to an emission limitation or standard unless the standard is an NSPS or NESHAP standard promulgated after November 15, 1990;
2. use a control device to achieve compliance with that emission limitation or standard; and
3. whose pre-control emissions of the regulated air pollutant are equal to or greater than 100% of the amount required for the source to be classified as a major source.

Also, per 40 CFR 64.2(b)(vi), a unit equipped with a continuous emissions monitoring (CEM) system is not required to develop a CAM plan. The Facility's PTE is not expected to be greater than 100% of the amount required for the source to be classified as a major source under the Title V program. Therefore, CAM regulations are not applicable.

4.6 Risk Management Program (40 CFR 68)

Title III of the 1990 CAA Amendments contains requirements for subject facilities that store and/or process certain hazardous substances for ensuring their safe use. Under these requirements, facilities must identify and assess their hazards and carry out certain activities designed to reduce the likelihood and severity of accidental chemical releases. Section 112(r) of the CAA, codified in 40 CFR Part 68, mandates the EPA to publish rules to develop and implement RMPs for sources with more than the threshold quantity of a listed regulated substance to identify, prevent, and minimize the consequences of accidental releases. The three elements that should be incorporated into an RMP include:

- Hazard Assessment;
- Prevention Program; and
- Emergency Response Program.

The Facility proposes to use 32.5% urea reagent in the SCRs on the engines, and as such the Risk Management Program requirements do not apply. Additionally, there are no RMP subject substances anticipated to be stored on-site in quantities greater than the threshold quantities listed in 40 CFR 68.130, Table 1. Therefore, the RMP will not apply.

4.7 Title V Program (40 CFR 70 and WAC 173-401)

A Title V operating permit is required for operating the Facility and is in addition to a pre-construction permit for any "major source" as defined in 173-401-200(19). In order to operate under a permit application shield, a complete and timely initial Title V permit application needs to be submitted within 12 months of beginning operation of the Facility. A

Title V permit contains detailed recordkeeping and reporting requirements associated with ongoing operation and regulatory compliance of the Facility.

The proposed 30 MW power plant will not be a Major Stationary Source as that term is defined in WAC 173 401-200(19) as the potential-to-emit any regulated air pollutant (as that term is defined in WAC 173-401-200[35]) from the Facility (including all exempt units) will be less than 100 tons/year and the potential-to-emit HAPs is less than 10 tons/year for any individual HAP and less than 25 tons/year for aggregate HAPs. Therefore, the operating permit regulations in WAC 173-401 are not applicable.

4.8 Acid Rain Program (40 CFR 72 and WAC 173-406)

The Acid Rain Program is codified in Title IV of the Clean Air Act. The purpose of this regulation is to reduce and or limit emissions of NO_X and SO_X which contribute to acid rain. It establishes certain general provisions and the operating permit program requirements for affected sources and affected units under the Acid Rain Program, pursuant to Title IV of the CAA. Further requirements for affected sources under Part 72 are outlined in 40 CFR 73, 74, 75, 76, 77, and 78.

Pursuant to 40 CFR 72.6(b)(9) and 40 CFR 72.7(a), new units (ones that have not previously lost an exemption) that serve one or more generators with total nameplate capacity of 25 MWe or less, that burn gaseous fuel with an annual average sulfur content of 0.05 percent or less by weight and that do not burn any coal or coal derived fuels are exempt from the requirements of the Acid Rain Program. The proposed engines will burn only natural gas and will not serve generators with a total nameplate capacity of 25 MWe or more. As such, the provisions of the Acid Rain Program are not expected to be applicable.

4.9 Greenhouse Gas Reporting, Mitigation, and Performance Standards for Power Plants (40 CFR 98, WAC 173-441, and WAC 173-407)

40 CFR 98 establishes mandatory GHG reporting requirements for owners and operators of certain facilities that directly emit GHG as well as for certain suppliers. Per 40 CFR 98.2(a)(1), "electricity generation units that report CO_2 mass emissions year-round through 40 CFR 75 (subpart D)" are part of the source categories presented in Table A-3 of 50 CFR 98 Subpart A. As such, pursuant to 40 CFR 98.2(a)(3), the power plant will be required to report under Part 98 if the aggregate maximum rated heat input capacity of the stationary fuel combustion units at the Facility is 30 MMBtu/hr or greater and if the Facility emits 25,000 metric tons CO_2e or more per year in combined emissions from all stationary fuel combustion sources (both conditions are expected to be satisfied). As such, GHG reporting obligations under 40 CFR 98 are expected to be applicable to the proposed facility.

WAC 173-441 establishes mandatory state-level GHG reporting requirements. This regulation was updated by Ecology in February 2022 to extend GHG reporting requirements to electric power entities that import or deliver 10,000 metric tons of GHG emissions per calendar year, expressed as carbon dioxide equivalents (CO_2e). As shown in **Appendix C**, the PTE for GHG emissions will exceed the reporting threshold for electric power entities. Therefore, the Facility will be subject to the mandatory reporting requirements pursuant to this regulation.

WAC 173-407 establishes GHG mitigation requirements and performance standards for certain power plants in accordance with legislative authority codified under the Revised Code of Washington (RCW) Chapter 80.80. Under RCW 80.80, the Washington State GHG emission performance standards (EPS) apply to electric generating plants or electric cogenerating plants that are (1) located in Washington, (2) designed and permitted to provide "baseload generation",[1] (3) generate more than 25 megawatts of electricity (MWe) but less than 350 MWe,[2] and (4) enter into a long-term financial commitments with an electric utility.[3] "Baseload generating facility" is defined as having a capacity factor greater than 60% while a "long-term financial commitment" is defined as being five (5) or more years in duration.

The proposed project would contract with the local electric utility (i.e., Grant County Public Utility Commission, GC-PUD) for a short-term period of less than five (5) years. As such, the GHG EPS law will not apply to this project.[4]

4.10 Washington State Energy Facility Site Evaluation Council (EFSEC)

Per the information available on EFSEC's website, certain facilities need certification or opt into EFSEC's siting process. Subject facility types include fission nuclear power facility, crude and natural gas pipelines, electrical transmission, petroleum refineries, thermal electrical generation etc.[5] For thermal electrical generation, EFSEC regulates stationary thermal power plants that can generate 350,000 kilowatts (kW) or more, or floating thermal power plants that can generate 100,000 kW or more. The proposed facility is 30,000 kW and as such is not regulated by the EFSEC.

4.11 Ecology Local Regulations

As noted previously, the proposed project will be constructed to comply with all applicable state and federal requirements in compliance with the federal and state Clean Air Acts.

4.11.1 General Standards for Maximum Emissions (WAC 173-400-040)

Regulations addressing general air pollution sources in Washington are contained in Chapter 173-400 of the WAC. Note that all of these general conditions will apply to the Facility, which is not exempt from any general requirements.

General standards for maximum emissions from air pollution sources in Washington are outlined in WAC 173-400-040 as follows:

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[1] Washington State Legislature. "WAC 173-407-110 – "Definitions to Part II and Part III". Available here: https://app.leg.wa.gov/WAC/default.aspx?cite=173-407-110. Accessed: November 2025.
[2] The Energy Facility Site Evaluation Council (https://efsec.wa.gov/) regulates plants larger than 350 MWe.
[3] Washington State Legislature. RCW 80.80.40 – "Greenhouse gas emissions performance standards—Rules—Sequestration". Available here: https://app.leg.wa.gov/RCW/default.aspx?cite=80.80.040. Accessed: November 2025.
[4] Washington Department of Ecology. "WSR 08-06-021 - PROPOSED RULES". Available here: https://app.leg.wa.gov/documents/laws/wsr/2008/06/08-06-021.htm. Accessed: November 2025.
[5] Who we regulate | EFSEC

- limit visible emissions to 20 percent opacity except for 3 minutes per hour;
- control of nuisance particulate fallout, fugitive dust, and odors; and
- limit SO_2 emissions to no more than 1,000 ppm (hourly average, 7 percent O_2, dry basis). VoltaGrid expects the maximum hourly SO_2 emissions from the Facility emission units will be well below the state limits.

4.12 New Sources of Toxic Air Pollutants (WAC 173-460)

As a new source, the Facility is required to conduct a TAP evaluation if maximum uncontrolled emissions of TAPs would be greater than the *de minimis* values identified in WAC 173-460-150. Each listed TAP has an established *de minimis* level, a Small-Quantity Emission Rate (SQER), and an Acceptable Source Impact Level (ASIL). If the TAP emission rate from a source is above its *de minimis* level and SQER, further determination of compliance with the ASIL is required.

Table 4-5 below shows the estimated TAP emission rate and *de minimis* value for each pollutant (further details on the emission calculations are provided **Appendix C**). As shown in **Table 4-5**, emission estimates indicate that fourteen (14) TAPs require review for the Facility under Chapter 173-460 WAC. BACT for TAPs (t-BACT) is addressed in **Section 5** and the ambient air quality assessment is addressed in **Section 6**.

Table 4-5 Project Emissions Compared to Small-Quantity Emission Rates (SQER)

Toxic Air Pollutant Emissions		Total Emissions for all Engines	De Minimis	SQER	Review Required
Pollutant	**Avg Period**	**Lb/Avg Period**			
Primary NO_2	1-hr	1.0	0.46	0.87	Model
CO	1-hr	24	1.1	43	Report
SO_2	1-hr	1.42	0.46	1.2	Model
NH_3	24-hr	85	1.9	37	Model
1,1,2,2-Tetrachloroethane	year	13	0.14	2.8	Model
1,1,2-Trichloroethane	year	10	0.51	10	Model
1,1-Dichloroethane	year	7.5	5.1	100	Report
1,2,3-Trimethylbenzene	24-hr	0.021	0.22	4.4	No
1,2,4-Trimethylbenzene	24-hr	0.013	0.22	4.4	No
1,2-Dichloroethane	year	7.5	0.31	6.2	Model
1,2-Dichloropropane	year	8.6	0.81	16	Report
1,3,5-Trimethylbenzene	24-hr	0.030	0.22	4.4	No

Table 4-5 Project Emissions Compared to Small-Quantity Emission Rates (SQER)

Toxic Air Pollutant Emissions		Total Emissions for all Engines	De Minimis	SQER	Review Required
Pollutant	Avg Period	Lb/Avg Period			
1,3-Butadiene	year	114	0.27	5.4	Model
1,3-Dichloropropene	year	8.4	2	41	Report
Acetaldehyde	year	2,671	3	60	Model
Acrolein	24-hr	4.7	0.0013	0.026	Model
Benz(a)anthracene	year	0.018	0.045	0.89	No
Benzene	year	141	1	21	Model
Benzo(a)pyrene	year	8.4E-04	0.0082	0.16	No
Benzo(b)fluoranthene	year	0.053	0.045	0.89	Report
Benzo(k)fluoranthene	year	2.4E-03	0.045	0.89	No
Carbon Tetrachloride	year	12	1.4	27	Report
Chlorobenzene	24-hr	0.028	3.7	74	No
Chloroethane	24-hr	1.7E-03	110	2200	No
Chloroform	year	9.1	0.35	7.1	Model
Chrysene	year	0.22	0.45	8.9	No
Dibenz(a,h)anthracene	year	8.4E-04	0.0041	0.082	No
Ethylbenzene	year	22	3.2	65	Report
Ethylene Dibromide	year	14	0.014	0.27	Model
Formaldehyde	year	12,467	1.4	27	Model
Indeno(1,2,3-c,d)pyrene	year	2.2E-03	0.045	0.89	No
Methanol	24-hr	2.3	74	1500	No
Methylene Chloride	year	6.4	490	9800	No
n-Hexane	24-hr	1.0	2.6	52	No
Naphthalene	year	24	0.24	4.8	Model
Perchloroethylene	year	0.79	1.3	27	No
Phenol	24-hr	0.022	0.74	15	No
Propylene	24-hr	4.7	11	220	No

Table 4-5 Project Emissions Compared to Small-Quantity Emission Rates (SQER)

Toxic Air Pollutant Emissions		Total Emissions for all Engines			
Pollutant	**Avg Period**	**Lb/Avg Period**	**De Minimis**	**SQER**	**Review Required**
Styrene	24-hr	0.022	3.2	65	No
Toluene	24-hr	0.38	19	370	No
Vinyl Chloride	year	4.8	0.92	18	Report
Xylenes	24-hr	0.57	0.82	16	No

4.13 State Environmental Policy Act

Because construction of the proposed equipment requires VoltaGrid to obtain an Order of Approval from Ecology, the requirements of Washington's State Environmental Policy Act (SEPA) must be satisfied. A SEPA checklist was submitted to the City of Quincy, the SEPA lead agency, in September 2025 (**Appendix B**). A Mitigated Determination of Non-Significance is expected to be issued prior to issuance of the Notice of Construction (air permit).

5. BEST AVAILABLE CONTROL TECHNOLOGY ASSESSMENT

5.1 Overview

The following sections present the BACT analyses for criteria pollutants and toxic air pollutants that were conducted to fulfill the permitting requirements for the project.

BACT is an emission limitation based on the maximum degree of reduction that can be feasibly achieved for each air pollutant emitted from any new or modified stationary source. BACT is required for new and modified industrial sources of criteria pollutants, and t-BACT is required for new or modified industrial sources of TAPs. A BACT analysis is conducted on a case-by-case basis and serves to develop an emissions limit derived from an evaluation of the degree of emissions reductions that each available emissions reducing technology or technique would achieve, as well as the energy, environmental, economic, and other costs associated with each technology or technique.

Pursuant to WAC 173-400-113(2), BACT is required for all new or modified minor sources, regardless of the power-generation scenario. Washington regulations require new or modified sources to employ BACT for all air pollutants not previously emitted, or whose emissions would increase as a result of the new source or modification. The intent of this Section is to present a BACT analysis for the proposed Jenbacher J620 natural gas-fired RICEs and natural gas-fired black start emergency engine.

5.2 BACT Analysis Methodology

Ecology determines BACT using a "top-down" approach as described in the EPA's draft NSR Workshop Manual: Prevention of Significant Deterioration and Non-Attainment Area Permitting.[6] The following five steps are involved in the top-down process:

1. STEP 1: Identify all available control technologies for the regulated pollutants under evaluation.
2. STEP 2: Determine the technical feasibility of potential control options and eliminate control options that are not technically feasible.
3. STEP 3: Rank remaining control options on the basis of control efficiency, where the top-ranked control alternative is the first selection of BACT.
4. STEP 4: Eliminate control options based on evaluation of economic, environmental and energy impacts.
5. STEP 5: Select the most effective option as BACT, which will be the most effective alternative not rejected based on economic, energy, and/or environmental impacts.

As the aforementioned BACT methodology suggests, if it cannot be shown that the top level of control is infeasible (for a similar type of source and fuel category) on the basis of technical, economic, energy, or environmental impact considerations, then that level of control must be declared to represent BACT for the respective pollutant and air emissions source. Alternatively, upon proper documentation that the top level of control is not feasible

[6] EPA. 1990. Draft: New Source Review Workshop Manual: Prevention of Significant Deterioration and Nonattainment Area Permitting. Office of Air Quality Planning and Standards, US Environmental Protection Agency. October. http://nepis.epa.gov/Exe/ZyPURL.cgi?Dockey=9100XFU4.txt. Accessed: August 2025.

for a specific unit and pollutant based on a site and project-specific consideration of the (i.e., technical, economic, energy, and environmental considerations), then the next most stringent level of control is similarly evaluated. This process continues until the BACT level under consideration cannot be eliminated by any technical, economic, energy, or environmental considerations. BACT cannot be determined to be less stringent than the emissions limits established by an applicable NSPS for the affected air emission source. In the case of the Jenbacher J620 natural gas-fired RICEs and the natural gas-fired black start emergency engine, BACT cannot be any less stringent than emissions standards in NSPS Subpart JJJJ.

A consolidated summary of the results of the USEPA's Reasonably Available Control Technology (RACT)/BACT/LAER Clearinghouse (RBLC) database search for natural gas-fired generator engines with a rating of greater than 500 horsepower over the last ten (10) years is presented in **Appendix E**.

5.3 J620 Engines

5.3.1 BACT for NO_X

For natural gas-fired engines, most of the NO_X generated during combustion is thermal NO_X, which is created when nitrogen (N_2) and oxygen (O_2) in the combustion air react at high temperatures. Selective non-catalytic reduction (SNCR) systems are not technically feasible for RICEs due to their temperature regime. Overfire air (OFA) and flue gas recirculation (FGR) are also not technically feasible control options. The SNCR, FGR and OFA technologies are therefore not discussed further.

5.3.1.1 STEP 1: Identify All Control Technologies

Lean Burn Technology

Lean burners use a lean mixture of fuel and air (a lower fuel per air ratio, which is also more excess air) to lower the combustion flame temperature, which in turns dampens NO_X formation. The proposed J620 engines are 4-stroke "lean burn" engines and by design, operate like low NO_X burners due to their lean burn configuration.

Selective Catalytic Reduction

An SCR system is the most common, post-combustion NO_X control technology on combustion devices. An SCR injects ammonia or urea solution into the flue gas to react with NO_X molecules in the presence of a catalyst, converting the NO_X back into N_2 and O_2.

A critical parameter to installing an SCR is the temperature environment of the exhaust. The SCR catalyst promotes reactions between NO_X and ammonia[7] molecules best in the 600 to 750°F. Outside of this temperature range, the catalyst activity is less and at high temperatures, the catalyst structure can start to sinter, resulting in a lowered life and need for frequent replacements. The design of the J620 4-stroke "lean burn" engines allows the SCR to be placed in the proper temperature regime in the exhaust stream.

[7] The facility proposes to use 32.5% urea as the reagent in its SCR systems. The urea converts to ammonia in the SCR and reacts with NO_X to achieve the desired reduction of NO_X to N_2 and H_2O.

5.3.1.2 STEP 2: Eliminate Technically Infeasible Options

Based on a review of the aforementioned NO_X control technologies, it can be concluded that lean burn design and SCRs for the J620 engines are technically feasible as control technology alternatives.

5.3.1.3 STEP 3: Rank Remaining Control Technologies by Control Effectiveness

Depending on the inlet NO_X loading, SCRs can achieve over 90 percent control in certain applications. Lean burn design are a standard offering with many natural gas-fired engines and it is not further discussed here due to is inherent application. SCRs are the most effective control for NO_X.

5.3.1.4 STEP 4: Evaluate Most Effective Controls

This section overviews the energy, environmental, and economic impacts of the control technologies. Good combustion practices and using clean fuels are not reviewed in this section because they are standard recommended operating procedures. Evaluating energy, environmental, and economic impacts from using good combustion practices to not following them is an exercise that results with many subjective scenarios due to operator failures.

Energy Impacts

The use of an SCR system may have significant energy impacts on engines. The additional backpressure on the engine will result in less energy output. In addition to the backpressure, the SCR system requires an ammonia storage, handling, and delivery system, which would include vaporizers and blowers to vaporize and dilute the ammonia or urea reagent for injection. The pumps and vaporizers will require energy.

Environmental Impacts

There are several environmental impacts associated with the use of SCR systems. First, SCR catalyst must be properly disposed, due to its classification as a hazardous waste. Therefore, spent catalyst needs to be handled and disposed of following hazardous waste procedures. The use of ammonia or urea solution in an SCR system introduces an element of environmental risk. Ammonia is listed as a hazardous substance under Title III Section 302 of the Superfund Amendments and Reauthorization Act of 1986 (SARA). However, the J620 units' SCR system will use urea as a reagent and not ammonia. As such, the inherent challenges associated with ammonia spills and releases are not of concern in this case.

Some unreacted ammonia (ammonia slip) from the stacks is unavoidable due to the imperfect distribution of the reagent and catalyst deactivation. Ammonia slip from an SCR system is one of the major design considerations that establishes catalyst life. Therefore, lower ammonia slip requirements ultimately limit catalyst life and dictate associated catalyst replacement.

The SCR catalyst can oxidize approximately 2 to 3 percent of the SO_2 in the flue gas to SO_3. If the flue gas cools below approximately 600 °F, the ammonia present in the flue gas may react with SO_3 to form ammonium sulfate and bisulfate salts. This formation may be dependent on the particular plume dispersion characteristics at the given time of stack discharge, which is dependent upon the temperature reached once the flue gas has left the stack. However, if the ammonia sulfate compounds are not formed, the SO_3 will react with the moisture in the flue gas to form H_2SO_4 in the atmosphere. Any ammonium sulfate and bisulfate salts and H_2SO_4 formed will increase the amount of PM emitted in the flue gas. The particulate material will predominately consist of matter less than 10 microns (i.e., PM_{10}). As

the catalyst gradually deactivates, more ammonia or urea must be injected to maintain the desired NO_X reduction. This results in an increased amount of ammonia slip for a given level of performance. Increased ammonia slip in turn results in additional ammonia salt formation that could result in increased opacity and particulate emissions.

Economic Impacts

An economic impact analysis was not performed as the installation of a SCR is included in the design of the J620 engine system.

5.3.1.5 STEP 5: Select BACT

The installation of an SCR is considered BACT for NO_X control on the proposed J620 engines. The SCR will control the NO_X emissions on the J620 engines by up to 98% during normal operation. The emission rate will be monitored using parametric monitoring and it is proposed that compliance with this limit be achieved based on a 30-day rolling average.

5.3.2 BACT for Particulate Matter

PM exists in two different forms – filterable particulate matter (FPM) and condensable particulate matter (CPM). Natural gas is a clean fuel and is relatively low on filterable content compared to other fossil fuels such as coal or oil. Since the engines are exclusively natural gas-fired, they do not emit large amounts of FPM. Each engine emits less than 0.5 tons of total PM per year. Due to very low levels of PM emissions, pollution controls have typically not been required to meet permitted emission limits for natural gas engines. PM emissions limits in permits are typically a function of the fuel being combusted combined with efficient fuel combustion.

PM control technologies typically employed on oil or coal-fired power plants, such as electrostatic precipitators and fabric filters would not offer much control for natural gas-fired RICE units due to the low PM concentration in the exhaust stream. From a search of the RBLC database, there are no natural gas-fired engines that have add-on PM controls installed. According to the RBLC database, the required controls for natural gas-fired RICE are the use of clean, low sulfur, low ash content fuel like natural gas and good combustion practices.

Therefore, the proposed BACT for PM from the natural gas-fired engines is the use of clean gaseous fuels such as natural gas and employing effective combustion practices. It is expected that BACT for PM satisfies BACT for any particulate toxics emitted from the internal combustion process.

5.3.3 BACT for SO_2

The most effective control for reducing SO_2 emissions from combustion process is to minimize the generation of SO_2, that is, utilize low sulfur fuels such as natural gas. The proposed J620 engines will be exclusively natural gas-fired. Potential emissions of SO_2 from the Facility are very low at approximately 6.2 tons/year and add-on control technologies such as dry flue gas desulfurization and wet scrubbing are expected to be extremely cost-prohibitive. Additionally, as such, the five-step BACT process was truncated.

Use of a clean fuel such as natural gas represents the top level of control for SO_2 from RICE engines. Therefore, the proposed BACT for SO_2 is the use of natural gas, a low sulfur fuel. The RICE proposed as part of the project will utilize natural gas which has an inherently low sulfur loading.

5.3.4 BACT for CO, VOC and Organic Toxic Air Pollutants

CO is generated from combustion processes when carbon in the fuel is insufficiently combusted, resulting in the formation of CO instead of CO_2. Incomplete combustion is caused by insufficient temperatures or O_2 in pockets of the combustion zones; therefore, it can be mitigated by increasing the overall temperature of the combustion process, providing excess air as well as thorough mixing between the fuel and air. However, there is a balance between controlling CO emissions versus generating NO_X emissions. As the combustion temperature increases, combustion becomes more complete, but hot regions within the combustion zone will generate NO_X. As combustion temperatures are lowered, NO_X formation decreases, but combustion is not as complete, resulting in higher CO concentrations.

Natural gas is primarily methane, but it contains many other compounds such as ethane, propane, butane, and other higher ordered carbohydrates. Most of these compounds readily combust in the RICE, but similar to CO formation, some of these compounds experience incomplete combustion and exist in the flue gas as VOCs (which includes organic air toxics).

5.3.4.1 STEP 1: Identify All Control Technologies

Good Combustion Practices

Good combustion practices refer to operating the unit in a manner that ensures quality combustion. Good combustion practices generally consist of proper monitoring of certain criteria (excess air, combustion temperature etc.) to allow operators to make adjustments as applicable. These include monitoring the NO_X, CO, and CO_2 concentrations in the flue gas, temperatures in the RICE, and monitoring the fuel quality. The RICEs should also be properly tuned according to the original equipment manufacturer's recommendations and maintained periodically to calibrate to the original tuning.

Oxidation Catalyst

An oxidation catalyst is the most prevalent method to reduce CO and VOC emissions post-combustion. The catalyst is a metal substrate that promotes the reaction between O_2 molecules in the flue gas with other pollutants, completing the combustion that did not occur inside the RICE. Oxidation catalysts do not specifically target one pollutant, so VOCs will be oxidized in addition to CO. Collaterally, oxidation of SO_2 into sulfur trioxide (SO_3) may also occur.

5.3.4.2 STEP 2: Eliminate Technically Infeasible Options

Based on a review of literature and prior applications of these for similar emission sources, it can be concluded that good combustion controls and oxidation catalysts are both technically feasible as control technology alternatives.

5.3.4.3 STEP 3: Rank Remaining Control Technologies by Control Effectiveness

Oxidation catalysts can achieve over 90 percent control in certain applications. For the J620 natural gas RICEs proposed at the Facility, a 95 percent control can be achieved via the use of an oxidation catalyst. Good combustion practices are a set of work practices that most combustion unit owners and operators follow anyway, and it is not further discussed here due to its implicit application.

5.3.4.4 STEP 4: Evaluate Most Effective Controls

This section provides an overview of the energy, environmental, and economic impacts of control technologies. Good combustion practices and using clean fuels are not reviewed in this section because they are standard recommended operating procedures.

Energy Impacts

The energy impact of installing an oxidation catalyst downstream of the RICE engine may result in an increase in the backpressure on the RICE.

Environmental Impacts

The major environmental disadvantage that exists when using an oxidation catalyst to reduce CO emissions is that a percentage of the SO_2 in the flue gas will oxidize to SO_3. Spent oxidation catalyst is made up of precious metals that are not considered toxic. This allows the catalyst to be handled and disposed of following normal waste procedures. Because of the precious metal content of the catalyst, the oxidation catalyst can also be recycled to recover the precious metals. The installation of an oxidation catalyst may increase the backpressure on the RICE, thereby decreasing its efficiency. This decrease in efficiency will lead to increased emissions of all pollutants on a unit power output basis. The oxidation of CO also directly results in increased production of CO_2, a greenhouse gas (GHG).

Economic Impacts

An economic impact analysis was not performed because the installation of an oxidation catalyst is included in the design of the proposed RICEs.

5.3.4.5 STEP 5: Select BACT

The installation of an oxidation catalyst is considered BACT for CO, VOC and Organic Toxic Air Pollutants control on the proposed J620 engines. The oxidation catalyst will control the CO, VOC and Organic Toxic Air Pollutants emissions by up to 95% during normal operation for the J620 engines. The post-control emission rate for CO and VOC will be monitored using parametric monitoring and it is proposed that compliance with this limit be achieved based on a 30-day rolling average.

5.3.5 BACT for GHGs

Greenhouse gases, specifically CO_2, CH_4, and N_2O, can be expressed as carbon dioxide equivalents (CO_2e). The primary source of these GHGs is the combustion of natural gas in the RICE. Natural gas is primarily methane, but it contains many other compounds such as ethane, propane, butane, and other higher ordered carbohydrates. Most of these compounds readily combust in the RICE to produce GHGs. Of the fossil fuels available, natural gas has the lowest emission factor for emissions of GHGs.

5.3.5.1 STEP 1: Identify All Control Technologies

Carbon Capture and Storage

Carbon Capture and Storage (CCS) is a technology aimed at reducing greenhouse gas emissions from large stationary sources such as power plants, refineries, and industrial facilities. The process involves three main steps:

- Capture – Separating carbon dioxide (CO_2) from flue gas or process streams using methods such as post-combustion absorption, pre-combustion gasification, or oxy-fuel combustion.

- Transport – Moving the captured CO_2, typically via pipeline, to a storage location.
- Storage – Injecting CO_2 deep underground into secure geological formations such as depleted oil and gas reservoirs, deep saline aquifers, or coal seams.

Fuel Substitution

Fuel substitution involves substituting fossil fuel with a lower carbon intensity fuel such as hydrogen blends or renewable natural gas.

Efficiency Improvements / Combustion Optimization

Efficiency improvements and combustion optimization are emission reduction strategies that focus on maximizing the performance of fuel-burning equipment while minimizing wasted energy. Techniques may include tuning air-to-fuel ratios, upgrading burners, installing advanced control systems, improving heat recovery, or reducing equipment downtime. By improving thermal efficiency and ensuring more complete combustion, facilities can lower fuel consumption and reduce greenhouse gas emissions (primarily CO_2), as well as criteria pollutants such as CO, NO_x, and VOCs.

Good Combustion Practices

Good Combustion Practices (GCP) are operational, and maintenance practices designed to ensure consistent, efficient, and complete fuel combustion. Key elements include proper tuning of air-to-fuel ratios, maintaining burners and ignition systems in good condition, minimizing equipment malfunctions, and operating within manufacturer-recommended load and temperature ranges.

5.3.5.2 STEP 2: Eliminate Technically Infeasible Options

Based on a review of literature and prior applications of these for similar emission sources, it can be concluded that CCS and fuel substitution are not technically feasible. CCS is not technically feasible for small-sized natural gas engines due to the absence of a nearby CO_2 pipeline and sequestration infrastructure and the prohibitively high cost of establishing such infrastructure. Limited availability of hydrogen/natural gas blends and/or renewable natural gas in the region make this control alternative technically infeasible.

5.3.5.3 STEP 3: Rank Remaining Control Technologies by Control Effectiveness

Good combustion practices are a set of work practices that most combustion unit owners and operators follow anyway, and it is not further discussed here due to its implicit application.

5.3.5.4 STEP 4: Evaluate Most Effective Controls

High-efficiency lean burn engines are commercially demonstrated, cost-effective and help improve the units' fuel-to-power conversion efficiency thereby reducing the quantity of CO_2 generated per unit of energy produced. Employing good combustion practices and following manufacturer's recommendations regarding operation and maintenance of the RICEs will also help ensure most efficient fuel combustion and minimize GHG emissions. No significant environmental, energy and economic impacts have been identified with implementation of these measures.

5.3.5.5 STEP 5: Select BACT

Based on the analysis presented above, BACT for GHG emissions is:

- Use of high-efficiency, natural gas-fired lean-burn J620 engines with electronic fuel/air controls. Implementation of good combustion and operational practices, including routine maintenance and tuning.
- Monitoring and recordkeeping of fuel use and engine operations to demonstrate efficiency.

5.3.6 J620 Engines: Recommended BACT and t-BACT

The Facility proposes to construct 14 Jenbacher J620 natural gas-fired RICEs, equipped with a built-in combustion exhaust treatment system consisting of a dual SCR and oxidation catalyst. As shown in **Appendix C**, manufacturer guarantees provide 98% control of NOx emissions and 95% control of CO, and VOC for the J620s. Organic toxics emissions are assumed to be controlled up to 90% for the J620s.

Controlled emission estimates for the RICEs fall well within the emission rates determined as BACT, as shown in **Table 1** of **Appendix E**. There are no add-on controls proposed for PM or SO_2 emissions, but the use of clean, low sulfur and low ash fuel such as natural gas satisfies BACT for these pollutants. Good combustion practices and use of natural gas will ensure that manufacturer guarantees for these pollutants will be satisfied.

TAP emissions from the Facility are classified as various species of VOCs, as shown in **Appendix C**. The oxidation catalyst used to control VOC emissions will also control TAP emissions with a guaranteed 95% control efficiency for the J620s. Potential emissions of ammonia (as ammonia slip) during SCR operation will be limited to no more than 5 ppm which meets the recent BACT determinations for similar applications. See **Table 2** of **Appendix E** for details.

5.4 Black Start Emergency Engine

5.4.1 BACT for NO_X, CO, VOC and Organic TAPs

For natural gas-fired engines, most of the NO_X generated during combustion is thermal NO_X, which is created when N_2 and O_2 in the combustion air react at high temperatures. The proposed natural gas-fired black start emergency engine is a rich burn (fuel-rich) engine.

As discussed in Section 5.3.1, SNCR, FGR and OFA technologies are not technically feasible and are therefore not discussed further. A rich burn engine's exhaust stream contains high concentrations of CO and unburned hydrocarbons which can poison the SCR catalyst. A rich burn engine's exhaust is too hot which results in thermal stress for the SCR catalyst. As such, an SCR is technically infeasible on a rich burn engine.

An NSCR catalyst is a precious-metal device, like a car's three-way converter, used on rich-burn engines (natural gas) to simultaneously reduce NOx, CO, and Hydrocarbons (HC) by using the excess fuel (CO/HC) as the reductant, requiring a precise, fuel-rich air/fuel ratio (around 0.5-1% O_2) for high efficiency, making it a common, cost-effective solution for stationary industrial engines to meet strict emissions standards.

5.4.1.1 STEP 1: Identify All Control Technologies

Non-Selective Catalytic Reduction (NSCR)

An NSCR system is the most common, post-combustion NO_X control technology on rich-burn engines. The design of the black start emergency engine allows the NSCR to be placed in the proper temperature regime in the exhaust stream.

5.4.1.2 STEP 2: Eliminate Technically Infeasible Options

Based on a review of the aforementioned NO_X control technologies, it can be concluded that an NSCR is technically feasible as a control technology alternative and no other add-on NOx controls are technically feasible.

5.4.1.3 STEP 3: Rank Remaining Control Technologies by Control Effectiveness

Depending on the inlet NO_X loading, NSCRs can achieve over 90 percent control in certain applications. As NSCRs are the only control technology to evaluate, NSCRs are the most effective control for NO_X.

5.4.1.4 STEP 4: Evaluate Most Effective Controls

This section overviews the energy, environmental, and economic impacts of the control technologies. Good combustion practices and using clean fuels are not reviewed in this section because they are standard recommended operating procedures. Evaluating energy, environmental, and economic impacts from using good combustion practices to not following them is an exercise that results with many subjective scenarios due to operator failures.

Energy Impacts

The use of an NSCR system may have energy impacts on engines. The additional backpressure on the engine will result in less energy output.

Environmental Impacts

There are two main environmental impacts associated with the use of SCR systems. First, SCR catalyst must be properly disposed, due to its classification as a hazardous waste. The NSCR catalyst may oxidize a small percentage of the SO_2 in the flue gas to SO_3. The SO_3 may react with the moisture in the flue gas to form H_2SO_4 in the atmosphere.

Economic Impacts

An economic impact analysis was not performed as the installation of an NSCR is included in the design of the black start emergency engine system.

5.4.1.5 STEP 5: Select BACT

The installation of an NSCR is considered BACT for NO_X, CO, VOC and organic TAPs control on the proposed black start emergency engine. The SCR will control the NO_X emissions on the black start emergency engine by approximately 99% during normal operation. The emission rate will be monitored using parametric monitoring and it is proposed that compliance with this limit be achieved based on a 30-day rolling average.

5.4.2 BACT for Particulate Matter

PM exists in two different forms – FPM and CPM. Natural gas is a clean fuel and is relatively low on filterable content compared to other fossil fuels such as coal or oil. Since the engine is exclusively natural gas-fired, it does not emit large amounts of FPM. The engine emits less than 0.005 tons of total PM per year. Due to very low levels of PM emissions, pollution controls have typically not been required to meet permitted emission limits for natural gas

engines. PM emissions limits in permits are typically a function of the fuel being combusted combined with efficient fuel combustion.

PM control technologies typically employed on oil or coal-fired power plants, such as electrostatic precipitators and fabric filters would not offer much control for natural gas-fired RICE units due to the low PM concentration in the exhaust stream. From a search of the RBLC database, there are no natural gas-fired emergency black start engines that have add-on PM controls installed. According to the RBLC database, the required controls for natural gas-fired RICE are the use of natural gas and good combustion practices.

Therefore, the proposed BACT for PM from the natural gas-fired black start emergency engine is the use of clean gaseous fuels such as natural gas and employing effective combustion practices. It is expected that BACT for PM satisfies BACT for any particulate toxics emitted from the internal combustion process.

5.4.3 BACT for SO_2

The most effective control for reducing SO_2 emissions from combustion process is to minimize the generation of SO_2, that is, utilize low sulfur fuels such as natural gas. The proposed black start emergency engine will be exclusively natural gas-fired. Potential emissions of SO_2 from the Facility are very low at approximately 1.4E-04 tons/year and add-on control technologies such as dry flue gas desulfurization and wet scrubbing are expected to be extremely cost-prohibitive. Additionally, as such, the five-step BACT process was truncated.

Use of a clean fuel such as natural gas represents the top level of control for SO_2 from natural gas-fire emergency RICE. Therefore, the proposed BACT for SO_2 is the use of natural gas, a low sulfur fuel. The black start emergency RICE proposed as part of the project will utilize natural gas which has an inherently low sulfur loading.

5.4.4 BACT for GHGs

Greenhouse gases, specifically CO_2, CH_4, and N_2O, can be expressed as CO_2e. The primary source of these GHGs is the combustion of natural gas in the RICE. Natural gas is primarily methane, but it contains many other compounds such as ethane, propane, butane, and other higher ordered carbohydrates. Most of these compounds are readily combusted in the RICE to produce GHGs. Of the fossil fuels available, natural gas has the lowest emission factor for emissions of GHGs.

5.4.4.1 STEP 1: Identify All Control Technologies

Carbon Capture and Storage

Carbon Capture and Storage (CCS) is a technology aimed at reducing greenhouse gas emissions from large stationary sources such as power plants, refineries, and industrial facilities. The process involves three main steps:

- Capture – Separating carbon dioxide (CO_2) from flue gas or process streams using methods such as post-combustion absorption, pre-combustion gasification, or oxy-fuel combustion.
- Transport – Moving the captured CO_2, typically via pipeline, to a storage location.
- Storage – Injecting CO_2 deep underground into secure geological formations such as depleted oil and gas reservoirs, deep saline aquifers, or coal seams.

Fuel Substitution

Fuel substitution involves substituting the fossil fuel with a lower carbon intensity fuel such as hydrogen blends or renewable natural gas.

Efficiency Improvements / Combustion Optimization

Efficiency improvements and combustion optimization are emission reduction strategies that focus on maximizing the performance of fuel-burning equipment while minimizing wasted energy. Techniques may include tuning air-to-fuel ratios, upgrading burners, installing advanced control systems, improving heat recovery, or reducing equipment downtime. By improving thermal efficiency and ensuring more complete combustion, facilities can lower fuel consumption and reduce greenhouse gas emissions (primarily CO_2), as well as criteria pollutants such as CO, NO_x, and VOCs.

Good Combustion Practices

Good Combustion Practices (GCP) are operational and maintenance practices designed to ensure consistent, efficient, and complete fuel combustion. Key elements include proper tuning of air-to-fuel ratios, maintaining burners and ignition systems in good condition, minimizing equipment malfunctions, and operating within manufacturer-recommended load and temperature ranges.

5.4.4.2 STEP 2: Eliminate Technically Infeasible Options

Based on a review of literature and prior applications of these for similar emission sources, it can be concluded that CCS and fuel substitution are not technically feasible. CCS is not technically feasible for small-sized natural gas engines due to the absence of a nearby CO_2 pipeline and sequestration infrastructure and the prohibitively high cost of establishing such infrastructure. Limited availability of hydrogen/natural gas blends and/or renewable natural gas in the region make this control alternative technically infeasible. Finally, the manufacturer design of the black start emergency engine prevents further combustion optimization through air-to-fuel ratios since it is a rich burn engine.

5.4.4.3 STEP 3: Rank Remaining Control Technologies by Control Effectiveness

Good combustion practices are a set of work practices that most combustion unit owners and operators follow anyway, and it is not further discussed here due to its implicit application.

5.4.4.4 STEP 4: Evaluate Most Effective Controls

Employing good combustion practices and following manufacturer's recommendations regarding operation and maintenance of the RICE will help ensure most efficient fuel combustion and minimize GHG emissions. No significant environmental, energy and economic impacts have been identified with implementation of these measures.

5.4.4.5 STEP 5: Select BACT

Based on the analysis presented above, BACT for GHG emissions is:

- Use of a rich-burn natural gas-fired engine.
- Implementation of good combustion and operational practices, including routine maintenance and tuning.
- Monitoring and recordkeeping of fuel use and engine operations to demonstrate efficiency.

5.4.5 Black Start Emergency Engine: Recommended BACT and t-BACT

In 1994, the USEPA began regulating emissions of NO_X, PM, CO, and nonmethane hydrocarbons (NMHC) from nonroad engines through a phased approach and has since issued multiple tiers of emission standards for various categories of engines.

Stationary engines are generally built to the same specifications as nonroad engines and are subject to the same tiered emission standards through NSPS Subpart JJJJ. The Facility proposes to construct 1 natural gas-fired black start emergency RICE, equipped with a built-in combustion exhaust treatment system consisting of an NSCR that controls emissions of NOx, CO, VOC and organic TAPs.

Controlled emission estimates for the RICEs fall well within the emission rates determined as BACT, as shown in **Table 1** of **Appendix E**. There are no add-on controls proposed for PM or SO_2 emissions, but the use of a clean, low sulfur and low ash fuel such as natural gas satisfies BACT for these pollutants. Good combustion practices and use of natural gas will ensure that manufacturer guarantees for these pollutants will be satisfied.

6. AIR QUALITY IMPACT ASSESSMENT

(Section IX of the NOC application form)

Ramboll prepared a dispersion modeling analysis to demonstrate that the proposed project is not expected to cause or contribute to a violation of the NAAQS or Washington Ambient Air Quality Standards (WAAQS) under WAC 173-476. The modeling assessment also evaluated compliance with WAC 173-460 ASILs for TAPs.

6.1 Modeling Methodology

Ramboll conducted modeling in accordance with EPA's 40 CFR 51 Appendix W 2024 Final Rule[8] and Ecology's Guidance Document First, Second and Third Tier Review of Toxic Air Pollutant Sources.[9] Ramboll presented the general modeling methodology to Ecology in the August 28, 2025 meeting and this methodology is described in detail in the following sections.

6.1.1 Model Selection

The most recent version of the AERMOD modeling system (Version 24142) was used for this analysis. AERMOD is the EPA-recommended model for near-field air quality modeling. The current model versions for the modeling system are:

- AERMAP 24142
- BPIP 04274
- AERMOD 24142
- AERMET 24142

6.1.2 Model Options

The regulatory default options were selected. The NO_X to NO_2 conversion was modeled using the Tier 3 PVMRM methodology with NO2STACK equal to 0.1 ppb (AERMOD default), NO2EQUIL equal to 0.9 ppb (AERMOD default), and OZONEVAL equal to 51.8 ppb from the NW-AIRQUEST 2014-2017 design value of criteria pollutants website, for the project area.

6.1.3 Emission Unit Representation

The Facility is comprised of 14 Jenbacher J620 natural gas-fired four-stroke lean-burn RICEs and one (1) natural gas-fired black start emergency engine. All project emission sources will be equipped with unobstructed, vertical stacks and will therefore, be modeled in AERMOD as POINT sources. The locations of the sources and base elevations are provided in **Table 6-1**.

[8] USEPA. (2024). "Guideline on Air Quality Models; Enhancements to the AERMOD Dispersion Modeling System." Available at: https://www.epa.gov/system/files/documents/2024-11/appendix_w-2024.pdf .

[9] Washington State Department of Ecology (2015). "Guidance Document First, Second, and Third Tier Review of Toxic Air Pollution Sources (Chapter 173-460 WAC)." Available at: https://apps.ecology.wa.gov/publications/documents/0802025.pdf .

Table 6-1 Facility Source Locations

Source ID	UTM Zone 11N NAD83		Base Elevation
	Easting	Northing	
	(m)	(m)	(m)
EGEN01	287,437.33	5,237,052.99	403.00
EGEN02	287,437.08	5,237,047.01	403.00
EGEN03	287,436.89	5,237,041.32	403.00
EGEN04	287,436.74	5,237,035.24	403.00
EGEN05	287,436.49	5,237,029.34	403.00
EGEN06	287,436.25	5,237,023.48	403.00
EGEN07	287,436.03	5,237,017.57	403.00
EGEN08	287,435.90	5,237,011.62	403.00
EGEN09	287,435.65	5,237,005.56	403.00
EGEN10	287,435.46	5,236,999.85	403.00
EGEN11	287,435.19	5,236,993.83	403.00
EGEN12	287,435.06	5,236,987.76	403.00
EGEN13	287,434.86	5,236,981.92	403.00
EGEN14	287,434.62	5,236,975.99	403.00
MESASTK1	287,388.94	5,237,050.34	403.00
MESASTK2	287,389.27	5,237,050.32	403.00

For the J620 RICEs, the stack temperature, stack velocity, and emission rates vary based on operating load. Therefore, a screening analysis was completed to identify the load that produced the highest modeled concentration for each averaging period and pollutant. The worst-case operating load for the PM standards was the 75% load case and for all other pollutants and averaging periods was the 100% load case, as shown in **Appendix C**. Each standard's respective worst-case operating load was used for all modeling demonstrations. The black start emergency engine will run at the 100% load case. The stack parameters for each of the 14 RICEs and one (1) black start emergency engine are summarized in **Table 6-2**.

Table 6-2 Modeled Stack Parameters

Source Type	Load (%)	Stack Height (ft)	Stack Temperature (°F)	Stack Exhaust Flow (acfm)	Stack Velocity (ft/min)	Stack Diameter (in)
EGEN	100	34	682	20,050	6,382	24
EGEN	75	34	783	16,241	5,170	24
MESASTK	100	10.4	950	1,169	13,393	4

The emissions for each of the 14 RICE sources and one (1) black start emergency engine are provided in **Appendix C**. The 1-hour, 3-hour, and 8-hour modeling demonstrations conservatively included 1 startup event per hour per J620 engine that each lasts for 5 minutes per event. The 24-hour modeling demonstrations conservatively included 1 startup event per day per J620 engine. Finally, the annual modeling demonstrations conservatively included 3 startup events per month per J620 engine for a total of 3 hours in startup mode per year per engine. The black start emergency engine was assumed to have no startup events. The black start emergency engine was assumed to operate for 100 hours per year and 4 hours per day.

Modeled emission rates for the project-only emissions are presented in **Table 6-3** and **Table 6-4** below.

Table 6-3 Modeled J620 Emission Rates

Pollutant	Averaging Time	Emission Rate (lb/hr)	Emission Rate (g/s)
Criteria Air Pollutants			
CO	8 hours	1.7	2.2E-01
	1 hour	1.7	2.2E-01
NO_X	Annual	0.14	1.8E-02
	1 hour	0.71	9.0E-02
$PM_{2.5}$	Annual	0.10	1.3E-02
	24 hours	0.079	9.9E-03
PM_{10}	24 hours	0.079	9.9E-03
SO_2	Annual	0.10	1.3E-02
	3 hours	0.10	1.3E-02
	1 hour	0.10	1.3E-02

Table 6-3 Modeled J620 Emission Rates

Pollutant	Averaging Time	Emission Rate	
		(lb/hr)	(g/s)
Toxic Air Pollutants			
Primary NO_2	1-hr	0.71	0.090
SO_2	1-hr	0.10	0.013
NH_3	24-hr	0.25	0.032
1,1,2,2-Tetrachloroethane	year	1.0E-04	1.3E-05
1,1,2-Trichloroethane	year	8.3E-05	1.0E-05
1,2-Dichloroethane	year	6.1E-05	7.7E-06
1,3-Butadiene	year	9.3E-04	1.2E-04
Acetaldehyde	year	0.022	2.7E-03
Acrolein	24-hr	0.014	1.7E-03
Benzene	year	1.1E-03	1.4E-04
Chloroform	year	7.4E-05	9.4E-06
Ethylene Dibromide	year	1.2E-04	1.5E-05
Formaldehyde	year	0.10	1.3E-02
Naphthalene	year	1.9E-04	2.4E-05

Table 6-4 Modeled Black Start Emergency Engine Emission Rates

Pollutant	Averaging Time	Emission Rate	
		(lb/hr)	(g/s)
Criteria Air Pollutants			
CO	8 hours	0.015	1.9E-03
	1 hour	0.015	1.9E-03
NO_X	Annual	7.2E-04	9.1E-05
	1 hour	0.063	8.0E-03
$PM_{2.5}$	Annual	5.3E-04	6.6E-05
	24 hours	7.7E-03	9.7E-04
PM_{10}	24 hours	7.7E-03	9.7E-04

Table 6-4 Modeled Black Start Emergency Engine Emission Rates

Pollutant	Averaging Time	Emission Rate	
		(lb/hr)	(g/s)
SO_2	Annual	1.6E-05	2.0E-06
	3 hours	1.4E-03	1.8E-04
	1 hour	1.4E-03	1.8E-04
Toxic Air Pollutants			
Primary NO_2	1-hr	0.063	8.0E-03
SO_2	1-hr	1.4E-03	1.8E-04
NH_3	24-hr	2.6E-03	3.3E-04
1,1,2,2-Tetrachloroethane	year	6.8E-07	8.6E-08
1,1,2-Trichloroethane	year	4.1E-07	5.2E-08
1,2-Dichloroethane	year	3.1E-07	3.9E-08
1,3-Butadiene	year	1.8E-05	2.3E-06
Acetaldehyde	year	7.6E-05	9.5E-06
Acrolein	24-hr	1.0E-03	1.3E-04
Benzene	year	4.3E-05	5.4E-06
Chloroform	year	3.7E-07	4.7E-08
Ethylene Dibromide	year	5.8E-07	7.3E-08
Formaldehyde	year	5.5E-04	7.0E-05
Naphthalene	year	2.6E-06	3.3E-07

6.1.4 Building Downwash

The Building Profile Input Program (BPIPPRM) was used to characterize the downwash effects from buildings and structures that can influence the dispersion from point sources. The facility layout used to create the BPIPPRM input file is presented in **Figure 4**. The building heights are presented in **Table 6-5**.

Table 6-5 Building Heights Considered for Building Downwash	
Building ID	**Building Height**
	(m)
ENCL01-14	7.36
BLKSTENC	3.06
CNGTRLRS	4.12

6.1.5 Meteorological Data

The analysis utilized five years of meteorological data from January 1, 2019 to December 31, 2023. The primary source for surface temperature, surface wind speed, and surface wind direction meteorological data is Ecology's meteorological monitor in Quincy, Washington, established in June 2017. The Quincy data is supplemented with data from the National Weather Service (NWS) hourly surface observations from Grant County International Airport (KMWH) in Moses Lake, Washington. NWS' twice-daily upper air soundings from Spokane, Washington were used for upper air data.

Surface characteristic data are also required for AERMET. The surface characteristic data were provided by the National Land Cover Database (NLCD) from the year 2023. The non-moisture climate variables required for the AERSURFACE module are snow, non-arid, and non-airport for Ecology's Quincy monitor and snow, non-arid, and airport for KMWH. The surface parameters for Ecology's Quincy monitor for years 2019, 2021, and 2022 were for dry moisture, 2020 was for average moisture, and 2023 was for wet moisture. The surface parameters for KMWH for years 2019, 2021, and 2022 were for dry moisture, and 2020 and 2023 were for average moisture. The meteorological data were processed with AERMET (version 24142) and the ADJ_U* option, which corrects for low wind speeds under very stable conditions. A wind rose for this meteorological data is provided in **Figure 5**.

6.1.6 Terrain

The United States Geologic Survey's 1/3 arc-second National Elevation Dataset (NED) was used as the basis for the terrain data. The latest version of AERMAP (version 24142) was used to determine the ground elevation and hill height scales for the receptors. The NED data has a horizontal resolution of 1/3 arc-second (10-meter intervals). The topography surrounding the Facility is as shown in **Figure 6**.

6.1.7 Receptor Grid

The Facility will be completely fenced and is a secured facility. Receptors were placed in ambient air and extend outward to a distance of 6.5 km from the facility fenceline (**Figure 7** and zoomed-in **Figure 4**). Along the fenceline, receptors were spaced at 12.5-meter intervals. The remaining receptor grid spacings followed Ecology modeling guidance[9] to create a nested grid of receptors of sufficient density to identify the maximum predicted concentrations:

- 12.5-meter spacing from the ambient air extending to 150 m
- 25-meter spacing from 150 m to 400 m from the Facility

- 50-meter spacing from 400 m to 900 m from the Facility
- 100-meter spacing from 900 m to 2 km from the Facility
- 300-meter spacing from 2 km to 4.5 km from the Facility
- 600-meter spacing from 4.5 km to 6.5 km from the Facility

6.2 NAAQS Modeling Results

The modeling followed all applicable guidance including 40 CFR Part 51 Appendix W (March 2025). Several components of this analysis were developed to ensure all modeling results are conservative and protective of air quality standards. This includes:

1. The inclusion of cold startup emissions for the J620 RICE units. The emission rates for the 1-hour, 3-hour, and 8-hour standards include the emissions of cold startup (5 minutes) plus steady state operations for the remainder of the hour (55 minutes). The emission rates for the 24-hour standards include the emissions of startup (5 minutes) plus warm operations for the remainder of the day (1,435 minutes). The emission rates for modeling against the annual standards assume 36 startup events per year per engine for a total of 3 hours of startup time and 8,757 hours of steady-state operation time.
2. Emission rates and stack parameters based on the worst-case load identified in the J620 RICE units screening modeling for all hours modeled.
3. Emission rates for the black start engine assuming an annual operation of 100 hours per year and daily operation of 4 hours per day for a 100% load.

The NAAQS modeling analysis was conducted in two steps:

1. The first step is to model the emission increases that result from the permitting action (i.e., the project). The model results are compared to established significant impact levels (SILs), which are used in permitting actions to define a de minimis level, below which the project is presumed to have an insignificant impact on air quality. For any pollutant (and averaging period) that has modeled concentrations below the SIL, the analysis in complete. For any pollutant (and averaging period) that has modeled concentrations above the SIL, the analysis proceeds to the second step.
2. The modeled concentrations from the project are added to the background air quality. The cumulative concentrations, in the form of the air quality standard, are then compared to the NAAQS. If the cumulative modeled concentrations are below the NAAQS, the analysis is complete. If the cumulative concentrations are above the NAAQS, it must be demonstrated that the project's contributions are below the SIL at the time and place of any modeled NAAQS violation.

The SILs and NAAQS are presented in **Table 6-6**.

The remainder of this section documents model inputs, assumptions, and results.

Table 6-6 Applicable Thresholds and Standards

Thresholds/ Standards	SIL[a] (µg/m³)	SIL Design Value (µg/m³)	NAAQS/WAAQS (µg/m³)	NAAQS/WAAQS Design Value (µg/m³)
1-hour NO_2	7.5	5-year average of H1Hs	188	Multiyear average of the 98th percentile of maximum daily 1-hour concentrations
Annual NO_2	1	H1H	100	Maximum annual mean
1-hour CO	2,000	H1H	40,000	Maximum H2H by year
8-hour CO	500	H1H	10,000	Maximum H2H by year
24-hour PM_{10}	5	H1H	150	Maximum H2H by year
24-hour $PM_{2.5}$	1.2	H1H	35	Multiyear average of the 98th percentile concentration
Annual $PM_{2.5}$	0.13	H1H	9	Multiyear average of the maximum annual mean
1-hour SO_2	7.8	5-year average of H1Hs	196	Multiyear average of the 99th percentile of maximum daily 1-hour concentrations
3-hour SO_2	25	H1H	1,310	Maximum H2H by year

Notes:

[a] SIL = significant impact level, from WAC 173-400-113, except 1-hour average NO_2 and SO_2, which are interim standards provided by EPA guidance memoranda[10,11] and the new EPA-recommended annual $PM_{2.5}$ SIL of 0.13 µg/m³.

Following the 2-step approach described above, the project-only emissions are modeled, and the modeled concentrations are compared to the SIL for the applicable criteria pollutant and averaging time. The overall, maximum modeled concentrations are summarized in **Table 6-7**. The pollutant/averaging time with modeled concentrations that exceed the SIL are 1-hour NO_2 and 24-hour and annual $PM_{2.5}$. The location for the maximum concentration of the project-only impacts for 24-hour $PM_{2.5}$ is on the western fenceline with a significant

[10] Page (2010a). "Guidance Concerning the Implementation of the 1-hour NO_2 NAAQS for the Prevention of Significant Deterioration Program."

[11] Page (2010b). "Guidance Concerning the Implementation of the 1-hour SO_2 NAAQS for the Prevention of Significant Deterioration Program."

impact area extending 0.12 km from the facility fenceline. The location for the maximum concentration of the project-only impacts for annual $PM_{2.5}$ is on the eastern fenceline with a significant impact area extending 0.01 km from the facility fenceline and does not overlap with nearby sources. The location for the maximum concentration of the project-only impacts for 1-hour NO_2 is on the western fenceline with a significant impact area extending 9.6 km from the facility fenceline. For all other pollutant/averaging times, modeled concentrations were below the SIL which demonstrates that the project will not cause or contribute to a modeled violation of the NAAQS.

Table 6-7 Significant Impact Analysis Results

Pollutant	Averaging Period	AERMOD File Name	Modeled Concentration[1] (µg/m³)	SIL[2] (µg/m³)	Over SIL?
NO_2[3,4]	1-Hour	vg.quincy.no2.1hr.inp	28	7.5	**YES**
	Annual	vg.quincy.no2.ann.inp	0.18	1	NO
CO	1-Hour	vg.quincy.co.inp	110	2,000	NO
	8-Hour	vg.quincy.co.inp	61	500	NO
PM_{10}[4]	24-Hour	vg.quincy.pm.24hr.inp	2.0	5	NO
$PM_{2.5}$[4]	24-Hour	vg.quincy.pm.24hr.inp	2.0	1.2	**YES**
	Annual	vg.quincy.pm.annual.inp	0.14	0.13	**YES**
SO_2[3,4]	1-Hour	vg.quincy.so2.1hr.inp	4.4	7.8	NO
	3-Hour	vg.quincy.so2.3hr.inp	5.2	25	NO

Notes:

1. Modeled concentrations are the maximum concentration predicted by the model for the applicable averaging period and were modeled at the worst-case load ≥50%. For the black start engines, the worst-case load is 100% for all pollutants and averaging periods. For the J620s, the worst-case load is 100% load for all pollutants and averaging periods except for 24-hour $PM_{2.5}$ and 24-hour PM_{10} which has worst-case emission at 75% load.

2. SIL = significant impact level, from WAC 173-400-113, except 1-hour average NO_2 and SO_2, which are interim standards provided by EPA guidance memoranda[10,11] and the new EPA-recommended annual $PM_{2.5}$ SIL of 0.13 µg/m³.

3. The model predicted concentration for the 1-hour average of NO_2 and SO_2 is represented by the 5-year average of the highest first highs per EPA guidance.[10,11]

4. The annual NO_2, 24-hour $PM_{2.5}$, 24-hour PM_{10}, and 3-hour SO_2 SIL results are the maximum impacts over all 5 years.

For those pollutants/averaging times that exceed the SIL, further cumulative modeling is required. Cumulative modeling includes impacts from the project sources and background concentrations.

The background concentrations were obtained from two different sources. The background concentration for NO_2 is from Ecology's August 2020 Storymap. The background concentration for 24-hour $PM_{2.5}$ is the 2024 design value from the Quincy monitor, which is the 98th percentile averaged over three years (2022-2024). The background concentration for annual $PM_{2.5}$ is the 2024 design value from the Quincy monitor, which is the annual mean averaged over three years (2022-2024). These background ambient values are summarized in Table **6**-**8** and were added to the cumulative modeled concentrations to demonstrate compliance with the NAAQS.

Table 6-8 Background Ambient Concentration for Cumulative NAAQS Demonstration

Averaging Period and Rank	Site	Background Ambient Concentration
		µg/m^3
1-hour NO_2 annual 98th percentile averaged over 3 years	Ecology Storymap	42
24-hour PM2.5 98th percentile	Quincy, 2022-2024	18
Annual PM2.5	Quincy, 2022-24	4.9

Nearby sources are not required to be considered in cumulative modeling. Based on discussions with Ecology, the background ambient concentrations presented in Table 6-8 are representative of all existing data center sources. Additionally, there is no overlap of the 24-hour $PM_{2.5}$ SIL, as shown in **Figure 8**. Finally, the expected maximum contribution from VDC, which is not included in the background, is 34 µg/m^3 for 1-hour NO_2. The VDC contributions to the 1-hour NO_2 NAAQS are shown in **Figure 9** as magenta crosses with the concentration labeled. It should be noted that the VDC modeling files were provided by Ecology and did not include the latest VDC facility edits, which consisted of adding 6 ft to the building height of WA13, increasing the stack diameters of the WA13 generators by 4 inches, and shifting the WA13 generators north by about 100 feet.

The overall maximum concentrations are summarized in **Table 6-9**. The locations of the overall maximum concentrations for 1-hour NO_2 occurs at the western fenceline border, for 24-hour $PM_{2.5}$ occurs at the eastern fenceline border, and for annual $PM_{2.5}$ occurs at the western fenceline border. The cumulative analysis demonstrates that the project will not cause or contribute to a modeled violation of the 1-hour NO_2, 24-hour $PM_{2.5}$, and annual $PM_{2.5}$ NAAQS.

Table 6-9 NAAQS Impact Analysis Results

Pollutant	Averaging Period	AERMOD File Name	Modeled Concentration[1] (µg/m³)	Background Concentration[2] (µg/m³)	Total Concentration (µg/m³)	NAAQS (µg/m³)	Above NAAQS?
NO_2	1-hour	vg.quincy.no2.1hr.out	18	42	60	188	NO
$PM_{2.5}$	24-hour	vg.quincy.pm.24hr.out	0.70	18	19	35	NO
$PM_{2.5}$	Annual	vg.quincy.pm.annual.out	0.12	4.9	5.0	9.0	NO

Notes:

1. For the NAAQS analysis, the 1-hour NO_2 and 24-hour $PM_{2.5}$ design concentrations are the five-year average of the 98th percentile of the respective daily maximum 1-hour averaged and 24-hour averaged concentrations. The annual $PM_{2.5}$ design concentration is the five-year average of the annual mean concentrations.

2. The background concentration for NO_2 is from Ecology's August 2020 Storymap. The background concentration for 24-hour $PM_{2.5}$ and annual $PM_{2.5}$ are from the Quincy monitor operating from 2022 to 2024.

6.3 First Tier Toxic Air Pollutant Analysis Results

As a result of the TAP evaluation from Section 4.12, there are fourteen (14) TAPs that require dispersion modeling to demonstrate compliance with the ambient impact requirement in WAC 173-460-070. These TAPs must undergo an acceptable source impact analysis where dispersion modeling results are compared to the ASILs listed in WAC 173-460-150. If the modeled concentration is below the ASIL, the analysis is complete. If the modeled concentration is above the ASIL, a Health Impact Assessment (HIA) is required to determine a means of compliance.

The overall maximum modeled concentrations are summarized in **Table 6-10**. There are no TAPs/averaging periods that exceed their respective ASILs. This demonstrates that the emissions from the project are protective of human health and safety from potential carcinogenic and/or other toxic effects.

Table 6-10 ASIL Impact Analysis Results

Pollutant	CAS No.	Averaging Period	AERMOD File Name	Facility-wide Emission Rate (lb/avg. period)	Project Concentration (µg/m³)	ASIL[a] (µg/m³)	Over ASIL?
Primary NO_2	10102-44-0	1-hr	vg.quincy.no2.1hr.inp	1.0	42	470	NO
SO_2	7446-09-5	1-hr	vg.quincy.so2.1hr.inp	1.4	6.6	660	NO
NH_3	7664-41-7	24-hr	vg.quincy.ammonia.inp	85	4.9	500	NO
1,1,2,2-Tetrachloroethane	79-34-5	year	vg.quincy.1122tetrachloroethane.inp	13	0.00014	0.017	NO
1,1,2-Trichloroethane	79-00-5	year	vg.quincy.112trichloroethane.inp	10	0.00011	0.063	NO
1,2-Dichloroethane	107-06-2	year	vg.quincy.12dichloroethane.inp	7.5	0.000084	0.038	NO
1,3-Butadiene	106-99-0	year	vg.quincy.13butadiene.inp	114	0.0013	0.033	NO
Acetaldehyde	75-07-0	year	vg.quincy.acetaldehyde.inp	2,671	0.030	0.37	NO
Acrolein	107-02-8	24-hr	vg.quincy.acrolein.inp	4.7	0.28	0.35	NO
Benzene	71-43-2	year	vg.quincy.benzene.inp	141	0.0017	0.13	NO
Chloroform	67-66-3	year	vg.quincy.chloroform.inp	9.1	0.00010	0.043	NO
Ethylene Dibromide	106-93-4	year	vg.quincy.ethylenedibromide.inp	14	0.00016	0.0017	NO
Formaldehyde	50-00-0	year	vg.quincy.hcho.inp	12,467	0.14	0.17	NO
Naphthalene	91-20-3	year	vg.quincy.naphthalene.inp	24	0.00027	0.029	NO

Notes:

[a] ASIL = Acceptable Source Impact Level, from WAC 173-460-150.

FIGURES

Figure 1 Site Location

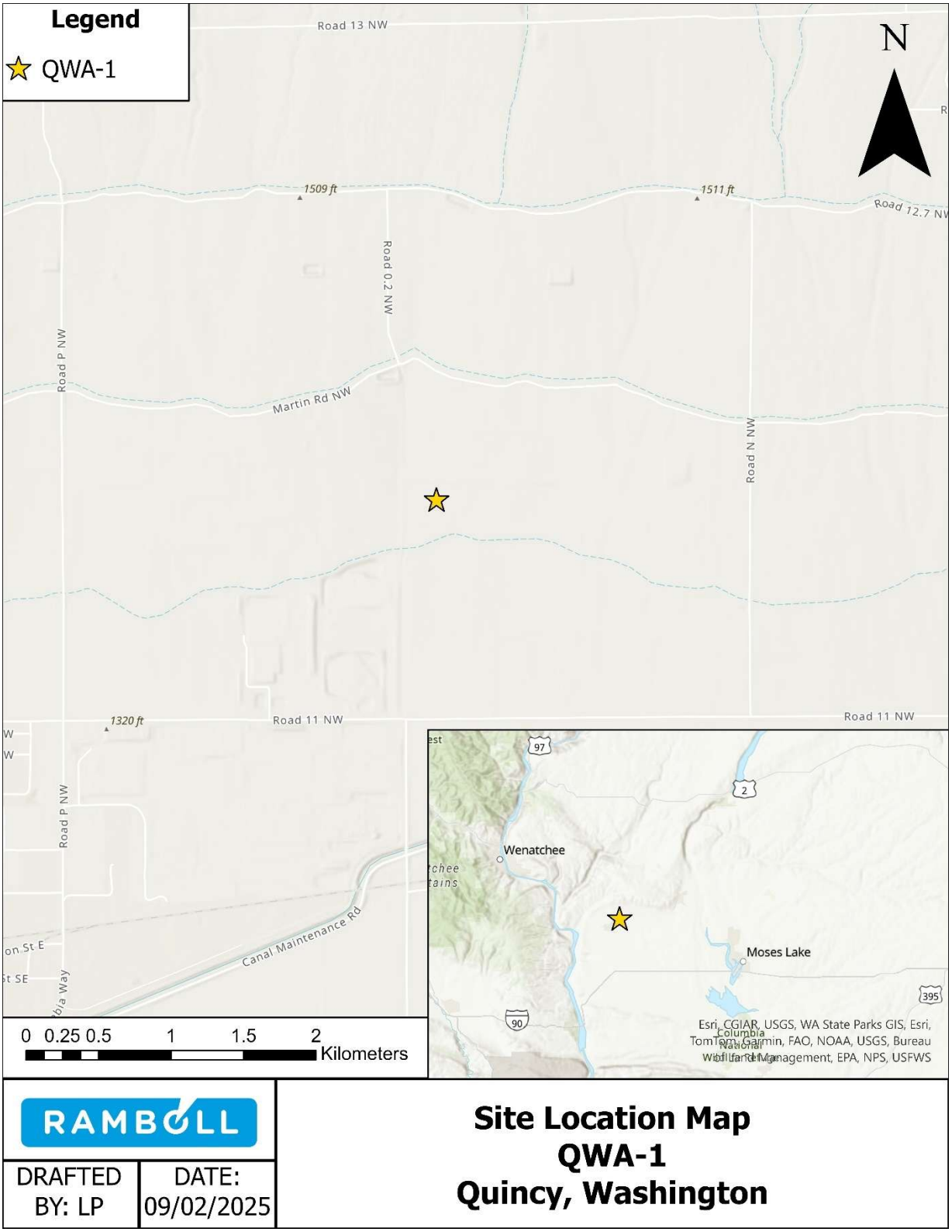


Figure 2 Site Layout Plan

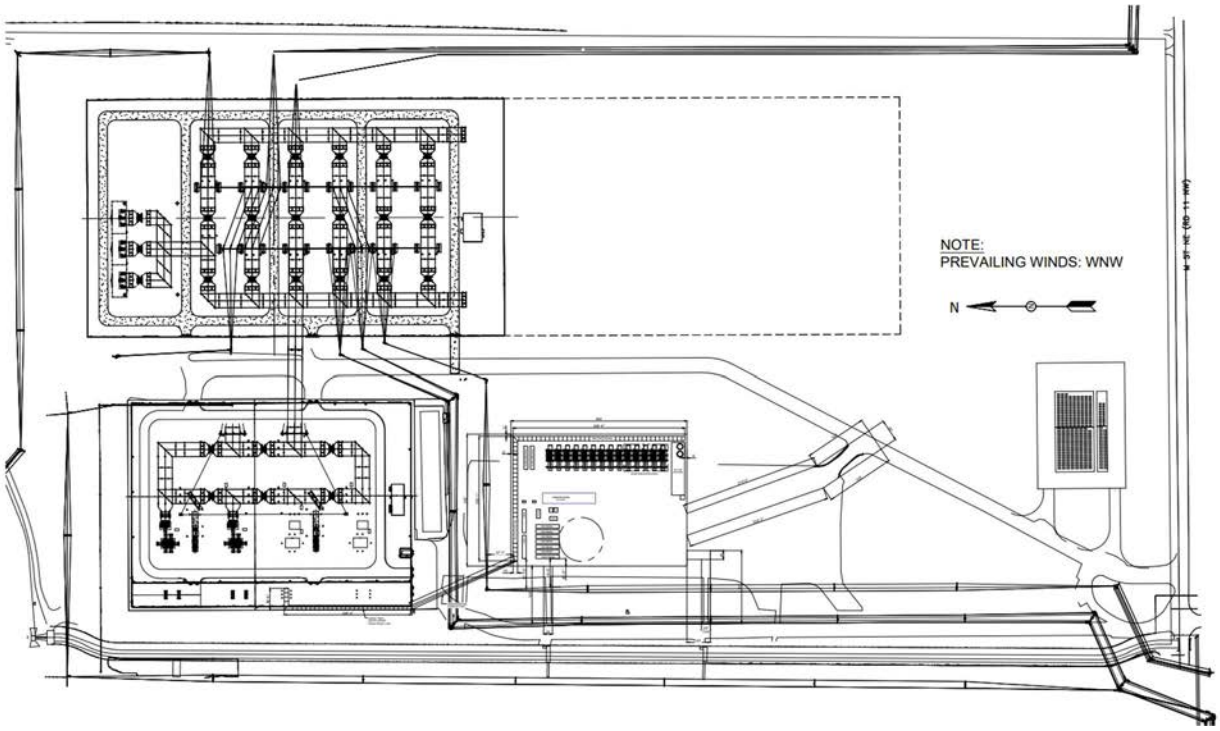
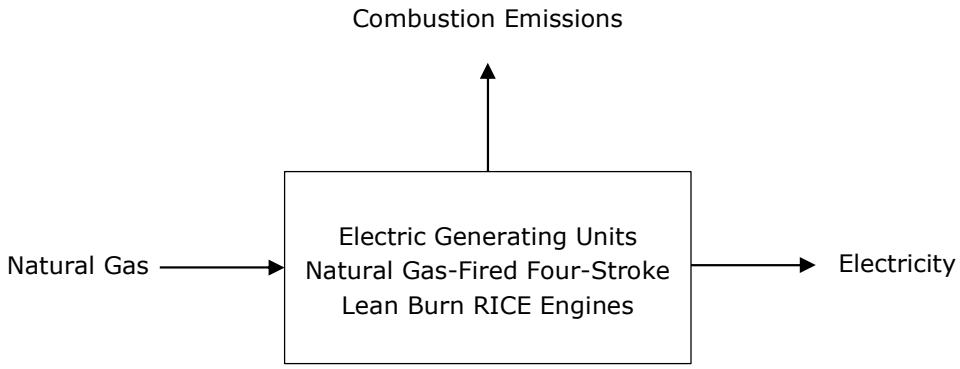


Figure 3 Process Flow Diagrams



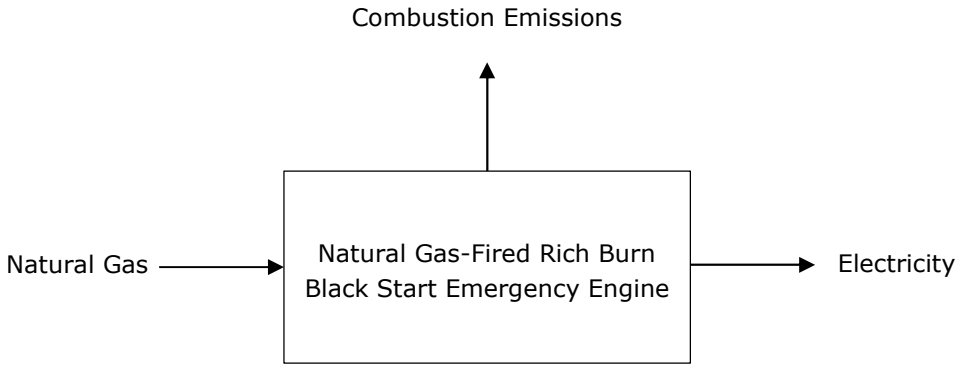


Figure 4 Buildings (Blue) Considered for Building Downwash Calculations

Figure 5 Station 24110 Wind Rose

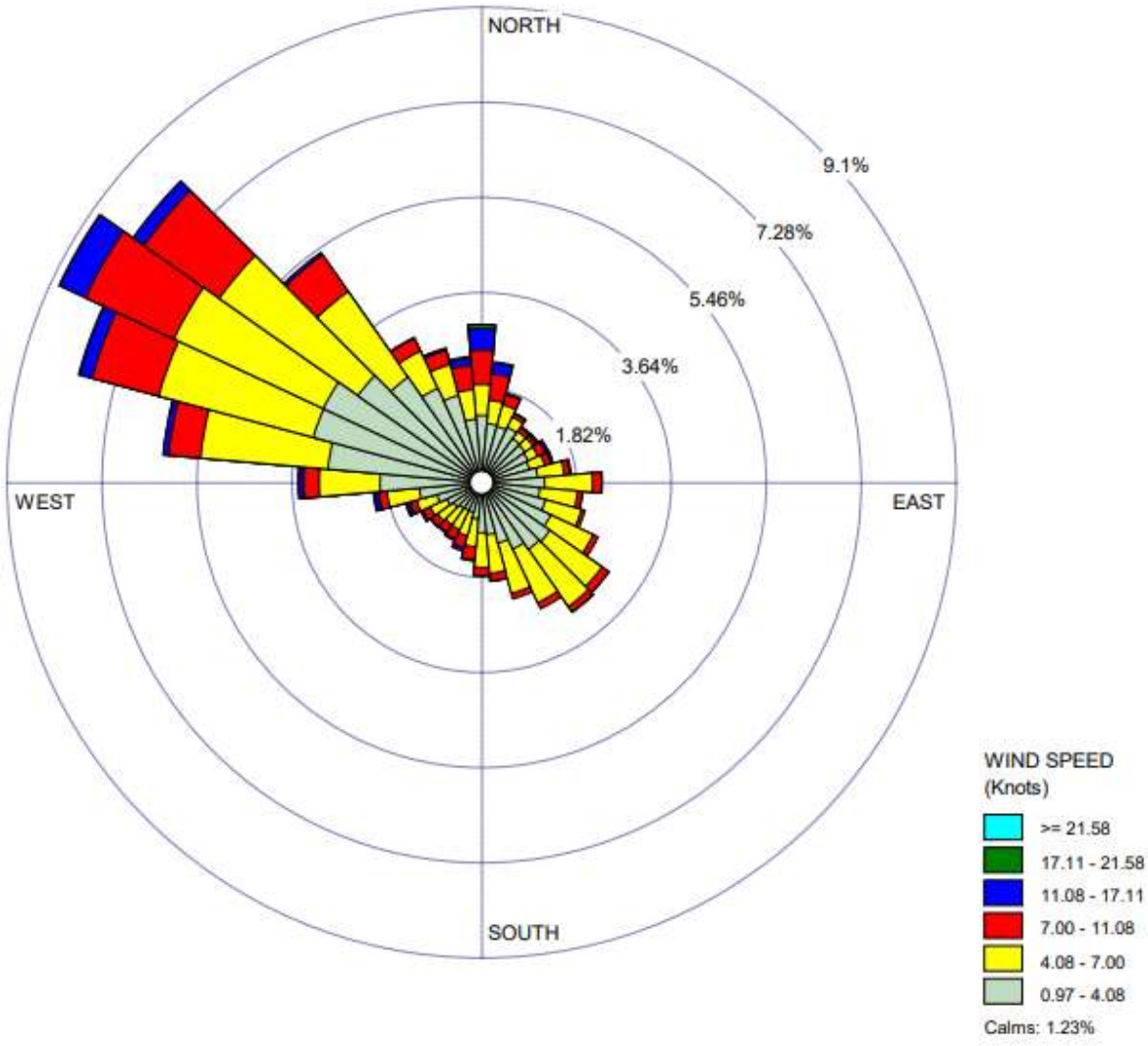


Figure 6 Topography in Project Area

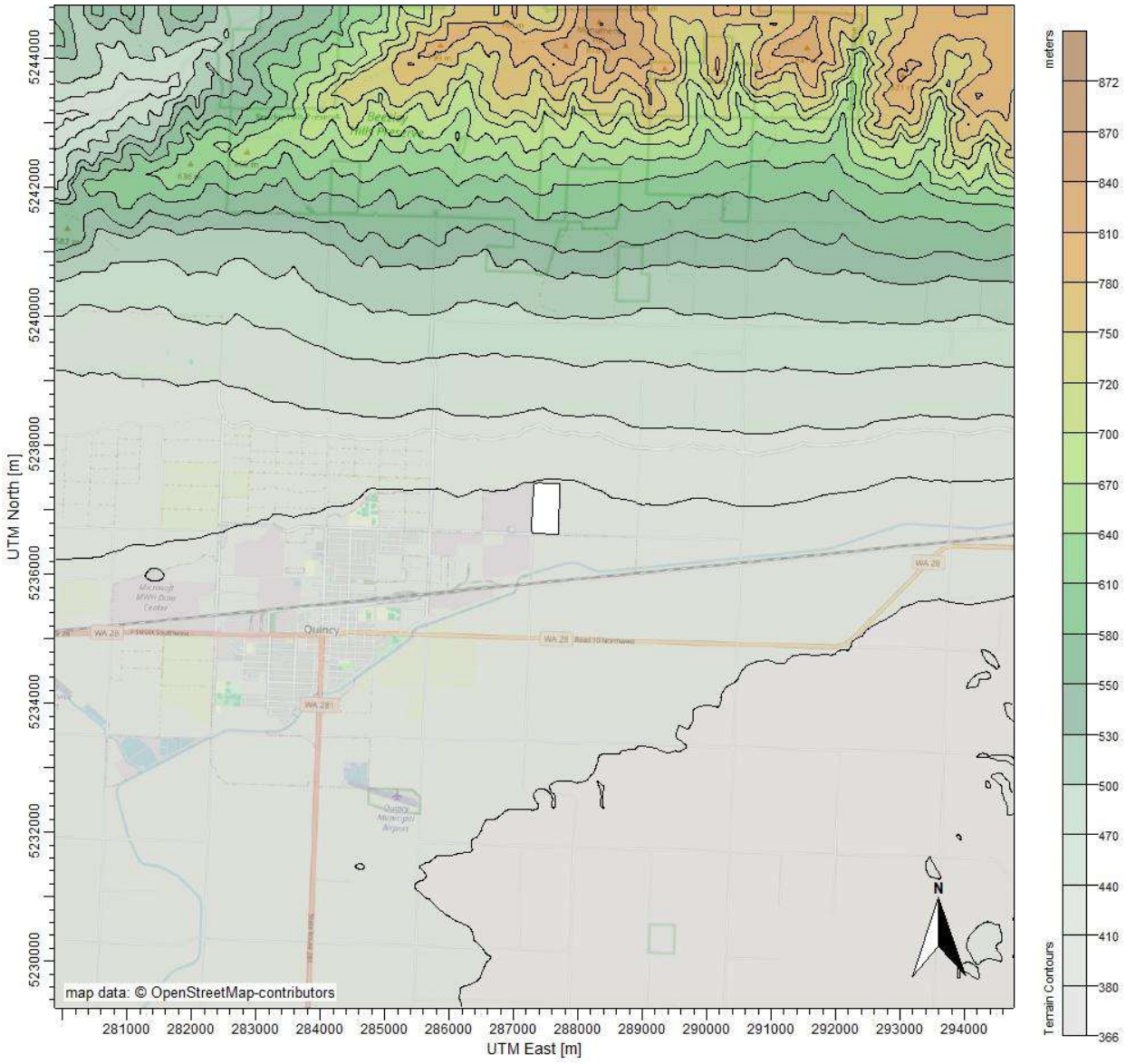


Figure 7 Modeling Receptor Grid

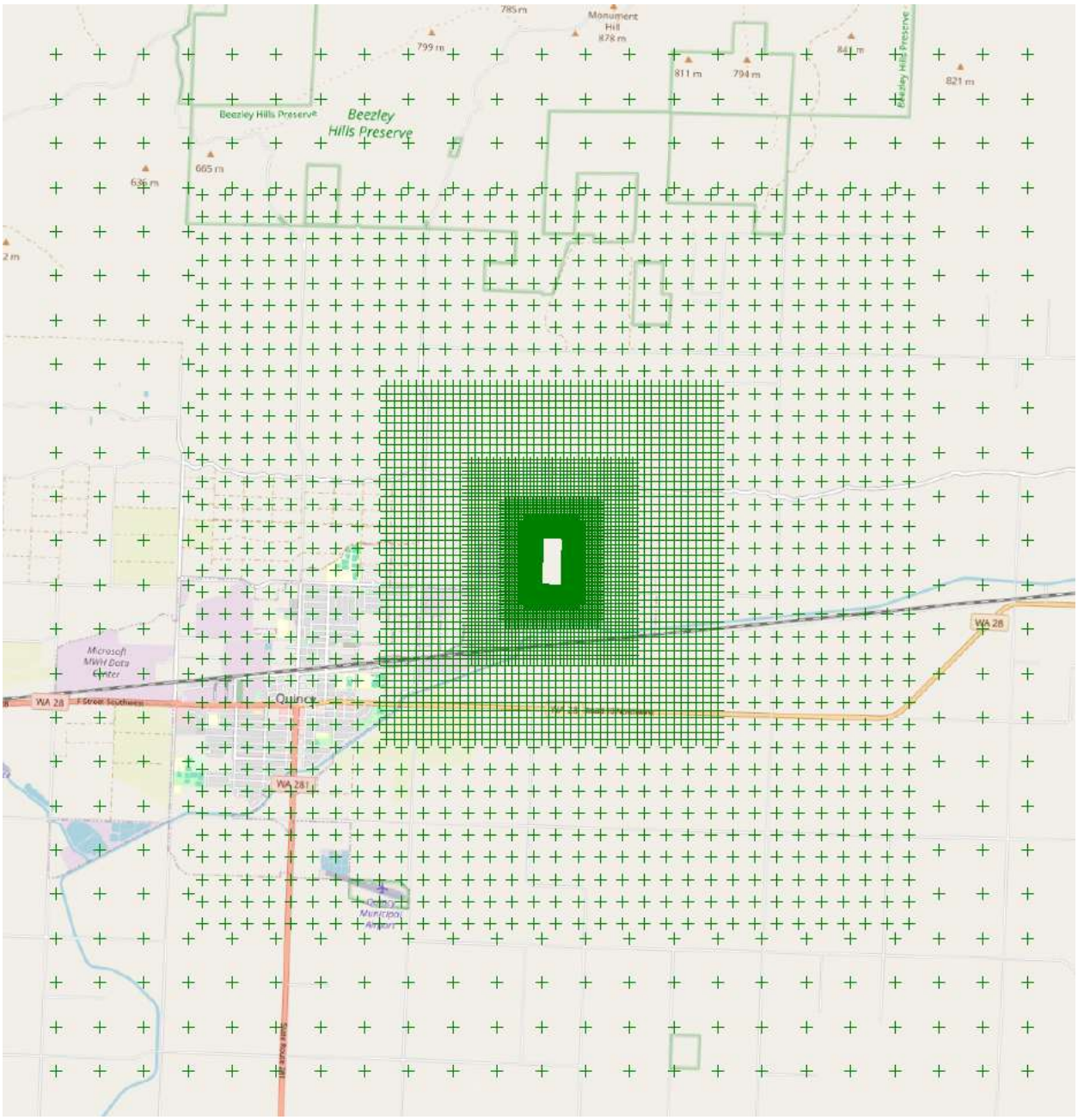


Figure 8 24-hour $PM_{2.5}$ High-First-High Values (SIL)

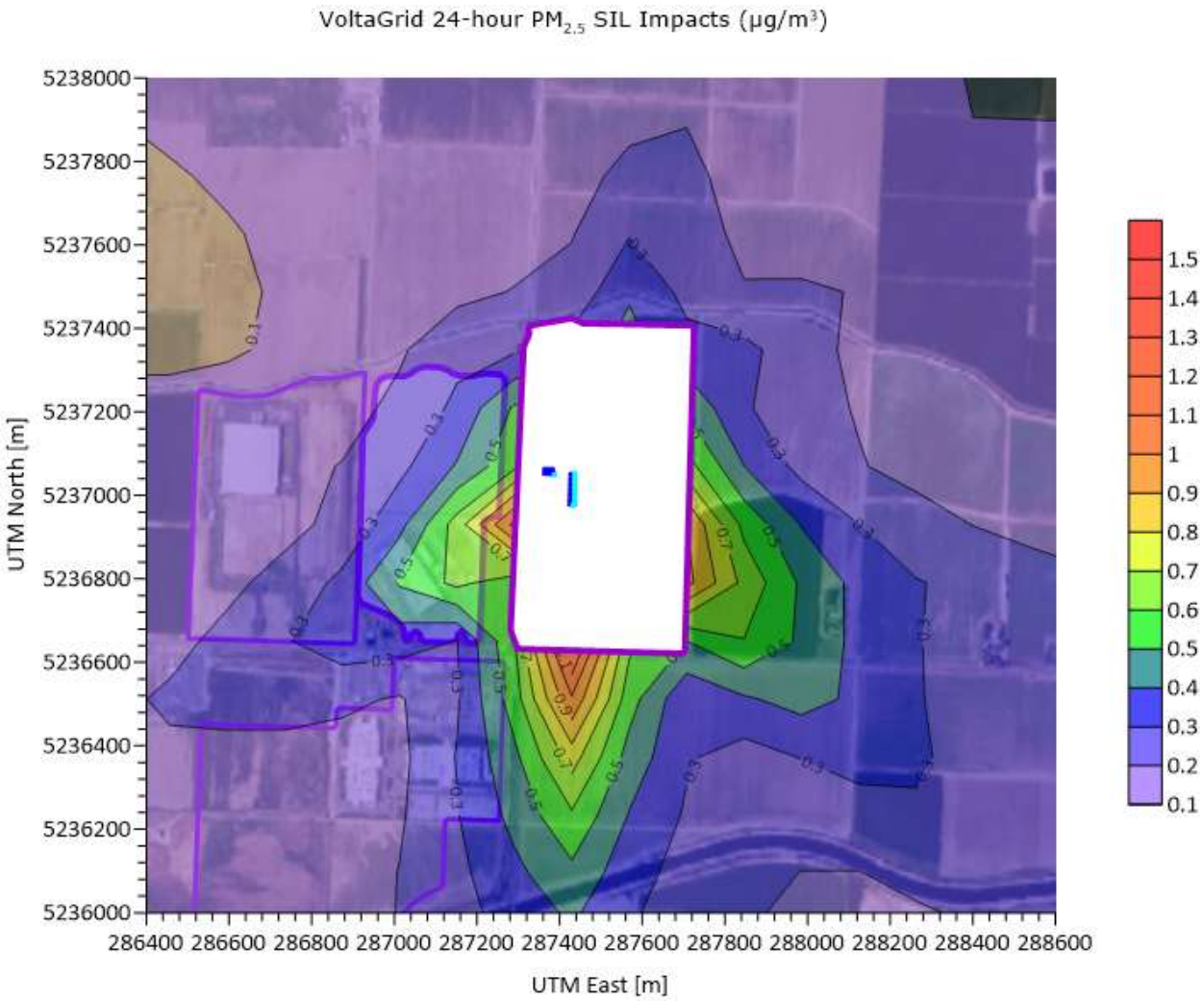
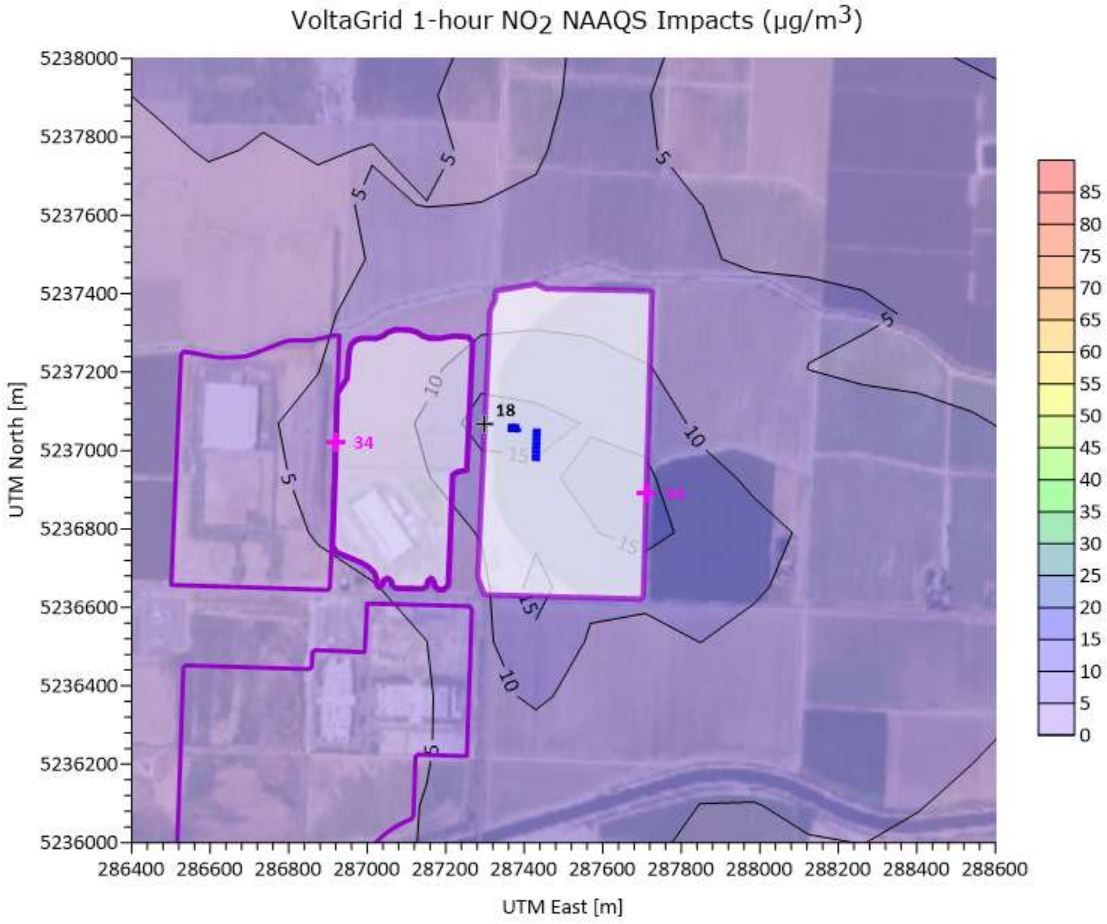


Figure 9 VoltaGrid 1-hour NO_2 NAAQS Project Impacts



Note: Pink + symbols represent Vantage Data Center's maximum 1-hour NAAQS impacts to the east and west of the facility boundary.

The black + symbol represents VoltaGrid's maximum 8th high impact of 1-hour NO_2.

APPENDIX A
NOTICE OF CONSTRUCTION PERMIT APPLICATION FORM

Notice of Construction Application

A notice of construction permit is required before installing a new source of air pollution or modifying an existing source of air pollution. This application applies to facilities in Ecology's jurisdiction. Submit this application for review of your project. For general information about completing the application, refer to Ecology Forms ECY 070-410a-g, "Instructions for Ecology's Notice of Construction Application."

Ecology offers up to two hours of free pre-application assistance. We encourage you to schedule a pre-application meeting with the contact person specified for the location of your proposal, below. If you use up your two hours of free pre-application assistance, we will continue to assist you after you submit Part 1 of the application and the application fee. You may schedule a meeting with us at any point in the process.

Upon completion of the application, please enclose a check for the initial fee and mail to:

Department of Ecology
Cashiering Unit
PO Box 47611
Olympia, WA 98504-7611

For Fiscal Office Use Only: 0299-3030404-B00-216--001--000404

Check the box for the location of your proposal. For assistance, call the appropriate office listed below:

Check box	Ecology Permitting Office	Contact
☐	**Chelan, Douglas, Kittitas, Klickitat, or Okanogan County** Ecology Central Regional Office (509) 575-2490	Lynnette Haller (509) 457-7126 lynnette.haller@ecy.wa.gov
☑	**Adams, Asotin, Columbia, Ferry, Franklin, Garfield, Grant, Lincoln, Pend Oreille, Stevens, Walla Walla, or Whitman County** Ecology Eastern Regional Office (509) 329-3400	Karin Baldwin (509) 329-3452 karin.baldwin@ecy.wa.gov
☐	**San Juan County** Ecology Northwest Regional Office (206) 594-0000	David Adler (425) 649-7267 david.adler@ecy.wa.gov
☐	**For actions taken at Kraft and Sulfite Paper Mills and Aluminum Smelters Only** Ecology Industrial Section (360) 407-6900	James DeMay (360) 407-6868 james.demay@ecy.wa.gov
☐	**For actions taken on the US Department of Energy Hanford Reservation Only** Ecology Nuclear Waste Program (509) 372-7950	Lilyann Murphy (509) 372-7951 lilyann.murphy@ecy.wa.gov

Check the box below for the fee that applies to your application.

New project or equipment:

- [x] **$1,904: Basic project** initial fee covers up to 16 hours of review.
- [ ] **$12,614: Complex project** initial fee covers up to 106 hours of review.

Change to an existing permit or equipment:

- [ ] **$357: Administrative or simple change** initial fee covers up to 3 hours of review. Ecology may determine your change is complex during the completeness review of your application. If you project is complex, you must pay the additional xxx before we will continue working on your application
- [ ] **$1,190: Complex** change initial fee covers up to 10 hours of review
- [ ] **$350flat fee**: Replace or alter control technology equipment under WAC 173-400-114. Ecology will contact you if we determine your change belongs in another fee category. You must pay the fee associated with that category before we will continue working on your application.

Read each statement below, then check the box next to it to acknowledge that you agree.

- [x] The initial fee you submitted may not cover the cost of processing your application. Ecology will track the number of hours spent on your project. If the number of hours Ecology spends exceeds the hours included in your initial fee, Ecology will bill you $119 per hour for the extra time.
- [x] You must include all information requested by this application. Ecology may not process your application if it does not include all the information requested.
- [x] Submittal of this application allows Ecology staff to visit and inspect your facility.

Part 1: General Information

I. Project, Facility, and Company Information

1. Project Name: New 30 MW Power Plant
2. Facility Name: WA-1 Electric Generation Plant
3. Facility Street Address:
   Facility is proposed to be located off Rd O NW next to the Quinc
4. Facility Legal Description: 30 MW Natural Gas-Fired Power Plant
5. Company Legal Name (if different from Facility Name):
   VoltaGrid LLC
6. Company Mailing Address (street, city, state, zip)

   10800 Telge Road Houston, Texas 77095

II. Contact Information and Certification

1. Facility Contact Name (who will be onsite): Korby Bracken, Senior Director-HSE
2. Facility Contact Mailing Address (if different than Company Mailing Address:
   10800 Telge Road Houston, Texas 77095

3. Facility Contact Phone Number: (307) 630-1430
4. Facility Contact E-mail: korby.bracken@voltagrid.com
5. Billing Contact Name (who should receive billing information):
   Korby Bracken, Senior Director-HSE
6. Billing Contact Mailing Address (if different Company Mailing Address):

   10800 Telge Road Houston, Texas 77095

7. Billing contact Phone Number: (307) 630-1430
8. Billing Contact E-mail: korby.bracken@voltagrid.com
9. Consultant Name (optional – if 3rd party hired to complete application elements):
   Sim Deshpande
10. Consultant Organization/Company: Ramboll Americas Engineering Solutions, Inc.
11. Consultant Mailing Address (street, city, state, zip): One Technology Park Drive, Westford, MA 01866
12. Consultant Phone Number: 508-314-0828
13. Consultant E-mail: sdeshpande@ramboll.com
14. Responsible Official Name and Title (who is responsible for project policy or decision making):
    Korby Bracken, Senior Director-HSE
15. Responsible Official Phone: (307) 630-1430
16. Responsible Official E-mail: korby.bracken@voltagrid.com
17. Responsible Official Certification and Signature:

    I certify that the information on this application is accurate and complete.

Signature: Korby Bracken Date: 9/5/25

Part 2: Technical Information

The Technical Information may be sent with this application form to the Cashiering Unit, or may be sent directly to the Ecology regional office with jurisdiction along with a copy of this application form.

For all sections, check the box next to each item as you complete it.

III. Project Description

- [x] Written narrative describing your proposed project.
- [x] Projected construction start and completion dates.
- [x] Operating schedule and production rates.
- [x] List of all major process equipment and manufacturer and maximum rated capacity.
- [x] Process flow diagram with all emission points identified.
- [x] Plan view site map.
- [x] Manufacturer specification sheets for major process equipment components
- [x] Manufacturer specification sheets for pollution control equipment.
- [x] Fuel specifications, including type, consumption (per hour and per year) and percent sulfur.

IV. State Environmental Policy Act (SEPA) Compliance

Check the appropriate box below.

- [ ] SEPA review is complete. Include a copy of the final SEPA checklist and SEPA determination (e.g., DNS, MDNS, and EIS) with your application.
- [ ] SEPA review has not been conducted:
  - [x] If review will be conducted by another agency, list the agency. You must provide a copy of the final SEPA checklist and SEPA determination before Ecology will issue your permit. Agency reviewing SEPA: City of Quincy
  - [ ] If the review will be conducted by Ecology, fill out a SEPA checklist and submit it with your application. You can find a SEPA checklist online at https://ecology.wa.gov/Regulations-Permits/SEPA/Environmental-review/SEPA-document-templates

V. Emissions Estimations of Criteria Pollutants

Does your project generate criteria air pollutant emissions? [x] **Yes** [ ] **No**

If yes, please proved the following information regarding your criteria emissions in the application.

- [x] The names of the criteria air pollutants emitted (i.e., NO_X, SO_2, CO, $PM_{2.5}$, PM_{10}, TSP, VOC, and Pb)
- [x] Potential emissions of criteria air pollutants in tons per hour, tons per day, and tons per year (include calculations)
- [ ] If there will be any fugitive criteria pollutant emissions, clearly identify the pollutant and quantity

VI. Emissions Estimations of Toxic Air Pollutants

Does your project generate toxic air pollutant emissions? [x] **Yes** [ ] **No**

If yes, please provide the following information regarding your toxic air pollutant emissions in your application.

- [x] The names of the toxic air pollutants emitted (specified in WAC 173-460-150[1])
- [x] Potential emissions of toxic air pollutants in pounds per hour, pounds per day, and pounds per year (include calculations)
- [ ] If there will be any fugitive toxic air pollutant emissions, clearly identify the pollutant and quantity

VII. Emission Standard Compliance

- [ ] Provide a list of all applicable new source performance standards, national emission standards for hazardous air pollutants, national emission standards for hazardous air pollutants for source categories, and emission standards adopted under Chapter 70A.15 RCW.

Does your project comply with all applicable standards identified? [x] **Yes** [ ] **No**

VIII. Best Available Control Technology

- [x] Provide a complete evaluation of Best Available Control Technology (BACT) for your proposal.

IX. Ambient Air Impacts Analyses

Please provide the following:

- [x] Ambient air impacts analyses for Criteria Air Pollutants (including fugitive emissions)
- [x] Ambient air impacts analyses for Toxic Air Pollutants (including fugitive emissions)
- [ ] Discharge point data for each point included in air impacts analyses (include only if modeling is required)
  - [x] Exhaust height
  - [x] Exhaust inside dimensions (ex. diameter or length and width)
  - [x] Exhaust gas velocity or volumetric flow rate
  - [x] Exhaust gas exit temperature
  - [x] The volumetric flow rate
  - [x] Description of the discharges (i.e., vertically or horizontally) and whether there are any obstructions (ex., raincap)
  - [x] Identification of the emission unit(s) discharging from the point
  - [x] The distance from the stack to the nearest property line
  - [x] Emission unit building height, width, and length
  - [x] Height of tallest building on-site or in the vicinity and the nearest distance of that building to the exhaust
  - [x] Whether the facility is in an urban or rural location

Does your project cause or contribute to a violation of any ambient air quality standard or acceptable source impact level? [ ] **Yes** [x] **No**

To request ADA accommodation, call Ecology at (360) 407-6800, 711 (relay service), or (877) 833-6341 (TTY)

[1] http://apps.leg.wa.gov/WAC/default.aspx?cite=173-460-150

APPENDIX B
STATE ENVIRONMENTAL POLICY ACT CHECKLIST

SEPA[1] Environmental Checklist

Purpose of checklist

Governmental agencies use this checklist to help determine whether the environmental impacts of your proposal are significant. This information is also helpful to determine if available avoidance, minimization, or compensatory mitigation measures will address the probable significant impacts or if an environmental impact statement will be prepared to further analyze the proposal.

Instructions for applicants

This environmental checklist asks you to describe some basic information about your proposal. Please answer each question accurately and carefully, to the best of your knowledge. You may need to consult with an agency specialist or private consultant for some questions. **You may use "not applicable" or "does not apply" only when you can explain why it does not apply and not when the answer is unknown.** You may also attach or incorporate by reference additional studies reports. Complete and accurate answers to these questions often avoid delays with the SEPA process as well as later in the decision-making process.

The checklist questions apply to **all parts of your proposal**, even if you plan to do them over a period of time or on different parcels of land. Attach any additional information that will help describe your proposal or its environmental effects. The agency to which you submit this checklist may ask you to explain your answers or provide additional information reasonably related to determining if there may be significant adverse impact.

Instructions for lead agencies

Please adjust the format of this template as needed. Additional information may be necessary to evaluate the existing environment, all interrelated aspects of the proposal and an analysis of adverse impacts. The checklist is considered the first but not necessarily the only source of information needed to make an adequate threshold determination. Once a threshold determination is made, the lead agency is responsible for the completeness and accuracy of the checklist and other supporting documents.

Use of checklist for nonproject proposals

For nonproject proposals (such as ordinances, regulations, plans and programs), complete the applicable parts of sections A and B, plus the Supplemental Sheet for Nonproject Actions (Part D). Please completely answer all questions that apply and note that the words "project," "applicant," and "property or site" should be read as "proposal," "proponent," and "affected geographic area," respectively. The lead agency may exclude (for non-projects) questions in "Part B: Environmental Elements" that do not contribute meaningfully to the analysis of the proposal.

[1] https://ecology.wa.gov/Regulations-Permits/SEPA/Environmental-review/SEPA-guidance/Checklist-guidance

A.Background

Find help answering background questions[2]

1. **Name of proposed project, if applicable:**

   QWA-1 Electric Generating Unit

2. **Name of applicant:**

   VoltaGrid LLC

3. **Address and phone number of applicant and contact person:**

   10800 Telge Road
   Houston, Texas 77095

   Korby Bracken, Senior Director-HSE
   korby.bracken@voltagrid.com
   +1 (307) 630-1430

4. **Date checklist prepared:**

   August 2025

   Updated November 2025 based on site modifications and inquires from Town of Quincy

5. **Agency requesting checklist:**

   City of Quincy

6. **Proposed timing of schedule (including phasing, if applicable):**

   Proposed start of construction is Q1 of 2026.

7. **Do you have any plans for future additions, expansion, or further activity related to or connected with this proposal? If yes, explain.**

   This proposal is for the full 30 megawatts of power needed to supplement the data center project.

8. **List any environmental information you know about that has been prepared, or will be prepared, directly related to this proposal.**

   VoltaGrid will be preparing and submitting a Notice of Intent application to allow construction and operation of the four-stroke lean burn (4SLB) internal combustion engines with the Washington Department of Ecology (Eastern Region Office). Each engine will be equipped with an exhaust treatment system consisting of a selective catalytic reduction (SCR) and oxidation catalyst to reduce the pollutants from engine combustion.

   A site-specific Spill Prevention, Control and Countermeasure plan will be developed and approved by a Professional Engineer in accordance with Environmental Protection Agency 40 Code of Federal Regulations Part 112.

[2] https://ecology.wa.gov/Regulations-Permits/SEPA/Environmental-review/SEPA-guidance/SEPA-checklist-guidance/SEPA-Checklist-Section-A-Background

Based on a Geotechnical Engineering Services Report – Revision 1, Dated July 23, 2025, provided by GCPUD the soils in the area consist of:

Upper Silt – was observed below the sod (which is now gravel) and primarily consisted of medium stiff to very stiff sandy silt and silt with sand. The upper silt unit extended to between 8 and 14.5 bgs.

Caliche – was observed below the upper silt unit and consisted primarily of medium dense to very dense silty sand to sand with silt and variable gravel content. Observed indications of cementation with this unit, resulting in the silty sand taking on more rock-like characteristic (caliche). The caliche unit extended to between 23 feet and 32 feet bgs. The depth to the top of the caliche unit is shallower in the borings to the north side of the total GCPUC property, approximately 9.5 feet bgs. The borings on the south side of the site, the depth of the top of caliche layer is relatively deeper, about 14.5 feet bgs.

Decomposed Basalt – was observed in borings below caliche unit. The basalt observed in the samples was highly decomposed and appeared similar to a course gravel or sand soil. The relative density of the decomposed basalt was typically dense to very dense. Decomposed basalt extended to the full depth explored in the borings, between 38.5 to 41.5 feet bgs.

9. Do you know whether applications are pending for governmental approvals of other proposals directly affecting the property covered by your proposal? If yes, explain.

All governmental approvals have been approved for other projects surrounding this property.

10. List any government approvals or permits that will be needed for your proposal, if known.

Washington Department of Ecology (Eastern Region Office) Notice of Intent approval.

11. Give brief, complete description of your proposal, including the proposed uses and the size of the project and site. There are several questions later in this checklist that ask you to describe certain aspects of your proposal. You do not need to repeat those answers on this page. (Lead agencies may modify this form to include additional specific information on project description.)

VoltaGrid has been contracted to provide supplemental power to a nearby data center through GCPUD's Quincy Foothills Substation. After full buildout VoltaGrid will place 14 mobile four-stroke lean-burn natural gas engines with exhaust treatment systems. Each engine and control system are mobile. Engines will be enclosed in a semi-tractor trailer. Each control system will be placed on a structure above each engine. Helical piles will be drilled each support leg on the control system to support each unit. Each engine will be supported by the trailer tires and landing gear on crushed gravel on location. A Command Center will be brought onsite to monitor operations at the VoltaGrid site. This will be a double wide trailer with computer equipment, desks and lavatories. Control Center will be on wheels chocked in place and leveled. Compressed Natural Gas (CNG) trailers will be filled offsite and delivered to location to provide fuel gas for the engines. A pressure reduction skid will be connected to the CNG trailers to decompress the gas for delivery to the engines.

Urea tanks will be required to store and distribute a 32.5% urea in water solution to reduce the nitrogen oxide (NOx) emissions in the exhaust.

12. **Location of the proposal. Give sufficient information for a person to understand the precise location of your proposed project, including a street address, if any, and section, township, and range, if known. If a proposal would occur over a range of area, provide the range or boundaries of the site(s). Provide a legal description, site plan, vicinity map, and topographic map, if reasonably available. While you should submit any plans required by the agency, you are not required to duplicate maps or detailed plans submitted with any permit applications related to this checklist.**

    Location of the proposed project is in Quincy, Washington in Section 4, Township 20N, Range 24 E at parcel 040414050. Approximate Latitude: 47° 15'07" N, 119°48'36" W. The site is east of Road O NW and north of Road L NW.

B.Environmental Elements

1. Earth

Find help answering earth questions[3]

a. **General description of the site:**

    Flat farm land that has been zoned industrial by the City of Quincy. Data centers are located to the west, Grant County Public Utility District substation to north, farm land to the east and south. Location is covered with crushed gravel post grading by GCPUD.

Circle or highlight one: Flat, rolling, hilly, steep slopes, mountainous, other:

b. **What is the steepest slope on the site (approximate percent slope)?**

    The steepest slope is approximately 5%.

c. **What general types of soils are found on the site (for example, clay, sand, gravel, peat, muck)? If you know the classification of agricultural soils, specify them, and note any agricultural land of long-term commercial significance and whether the proposal results in removing any of these soils.**

    The general soil at the site is Warden silt loam and Taunton silt loam. GCPUD has cleared the site and covered in crushed rock/gravel.

d. **Are there surface indications or history of unstable soils in the immediate vicinity? If so, describe.**

    There are no surface indications or history of unstable soils in the vicinity.

e. **Describe the purpose, type, total area, and approximate quantities and total affected area of any filling, excavation, and grading proposed. Indicate source of fill.**

[3] https://ecology.wa.gov/regulations-permits/sepa/environmental-review/sepa-guidance/sepa-checklist-guidance/sepa-checklist-section-b-environmental-elements/environmental-elements-earth

Site is already prepared. VoltaGrid will be adding helical piles for control system base support.

f. Could erosion occur because of clearing, construction, or use? If so, generally describe.

Erosion is not likely to occur during the construction and operational phases of the project. Slope and rock cover will maintain soil stability. Best Management Practices will be incorporated for storm water.

g. About what percent of the site will be covered with impervious surfaces after project construction (for example, asphalt or buildings)?

100% will be covered in crushed rock/gravel. Site VoltaGrid will occupy is ~300' X 400' of GCPUD's Quincy Foothills Substation.

Description	Length X Width	Area		Percent of Project Area
		Square Feet	Acres	
Total Site	400' X 300'	120,000	2.76	100.0%
Engines	334' X 61'	20,374	0.47	17.0%
Control Center	60' X 24'	1,440	0.03	1.2%
PRS	53' X 24'	1,272	0.03	1.1%
CNG Trailers	60' X 53'	3,180	0.07	2.7%
Urea Tank	60' X 60'	3,600	0.08	3.0
Total Covered	-	**29,866**	**0.68**	**25.0%**

h. Proposed measures to reduce or control erosion, or other impacts to the earth, if any.

Following construction, the site will have buildings and be covered with crushed rock/gravel. No exposed soils are expected.

2. Air

Find help answering air questions[4]

a. What types of emissions to the air would result from the proposal during construction, operation, and maintenance when the project is completed? If any, generally describe and give approximate quantities if known.

Construction: Vehicle emissions from work trucks and construction vehicles including cranes to build the engine modules. Construction equipment emissions will occur from pile drilling and engine transportation. Site will employ watering as necessary to mitigate particulate emissions.

[4] https://ecology.wa.gov/Regulations-Permits/SEPA/Environmental-review/SEPA-guidance/SEPA-checklist-guidance/SEPA-Checklist-Section-B-Environmental-elements/Environmental-elements-Air

Operation: Exhaust from 4SLB engines treated with SCR and oxidation catalyst system. Semi tractor emissions to bring in loaded Compressed Natural Gas (CNG) trailers and remove empty CNG trailers. Vehicle traffic from workers arriving and departing location.

b. Are there any off-site sources of emissions or odor that may affect your proposal? If so, generally describe.

Odorized natural gas is utilized for fuel gas. Odor is added for leak detection, identical to natural gas utilized in residential applications.

c. Proposed measures to reduce or control emissions or other impacts to air, if any:

Natural gas needs to be odorized for safety purposes. It allows for olfactory detection of any potential leaks in the system.

3. Water

Find help answering water questions[5]

a. Surface:

Find help answering surface water questions[6]

1. Is there any surface water body on or in the immediate vicinity of the site (including year-round and seasonal streams, saltwater, lakes, ponds, wetlands)? If yes, describe type and provide names. If appropriate, state what stream or river it flows into.

There is an irrigation ditch that parallels Road O NW. That ditch is approximately 250 feet from the VoltaGrid project area. That ditch appears to tie in an irrigation canal ~1,500 feet to the north of the project area and a canal ~3,110 feet to the south. There are no lakes, ponds or stagnant water bodies identified.

Crushed rock and grading (already in place) will prevent any onsite soils from reaching the irrigation ditch to the east of the proposed project area. Silt fence will be added around the VoltaGrid project area as an additive measure. Additionally, Road O NW separates the site from the irrigation ditch.

2. Will the project require any work over, in, or adjacent to (within 200 feet) the described waters? If yes, please describe and attach available plans.

Pilings will be drilled ~250 feet from the irrigation ditch west of the project area. Being helical piles there is no soil removed. The ditch is protected by Road O NW; also, crushed gravel, grading and silt fence is already in place or will be added.

[5] https://ecology.wa.gov/Regulations-Permits/SEPA/Environmental-review/SEPA-guidance/SEPA-checklist-guidance/SEPA-Checklist-Section-B-Environmental-elements/Environmental-elements-3-Water
[6] https://ecology.wa.gov/Regulations-Permits/SEPA/Environmental-rsepaeview/SEPA-guidance/SEPA-checklist-guidance/SEPA-Checklist-Section-B-Environmental-elements/Environmental-elements-3-Water/Environmental-elements-Surface-water

3. **Estimate the amount of fill and dredge material that would be placed in or removed from surface water or wetlands and indicate the area of the site that would be affected. Indicate the source of fill material.**

   No fill or dredge material will be placed in or removed from any waterways or wetlands as part of the project.

4. **Will the proposal require surface water withdrawals or diversions? Give a general description, purpose, and approximate quantities if known.**

   No surface water withdrawals or diversions are required for this project.

5. **Does the proposal lie within a 100-year floodplain? If so, note location on the site plan.**

   The project does not lie within a 100-year floodplain.

6. **Does the proposal involve any discharges of waste materials to surface waters? If so, describe the type of waste and anticipated volume of discharge.**

   The project does not have any discharges of waste materials to surface waters.

b. Ground:

Find help answering ground water questions[7]

1. **Will groundwater be withdrawn from a well for drinking water or other purposes? If so, give a general description of the well, proposed uses and approximate quantities withdrawn from the well. Will water be discharged to groundwater? Give a general description, purpose, and approximate quantities if known.**

   Groundwater will not be withdrawn from a well. Plan is to utilize municipal water for drinking and restrooms.

2. **Describe waste material that will be discharged into the ground from septic tanks or other sources, if any (domestic sewage; industrial, containing the following chemicals…; agricultural; etc.). Describe the general size of the system, the number of such systems, the number of houses to be served (if applicable), or the number of animals or humans the system(s) are expected to serve.**

   No waste material will be discharged into the ground from septic tanks or other sources.

c. Water Runoff (including stormwater):

1. **Describe the source of runoff (including storm water) and method of collection and disposal, if any (include quantities, if known). Where will this water flow? Will this water flow into other waters? If so, describe.**

   VoltaGrid will be utilizing GCPUD surface. Site is prepared and covered in crushed rock/gravel. Storm water silt leaving site is unlikely but silt fence and BMPs will be in

[7] https://ecology.wa.gov/Regulations-Permits/SEPA/Environmental-review/SEPA-guidance/SEPA-checklist-guidance/SEPA-Checklist-Section-B-Environmental-elements/Environmental-elements-3-Water/Environmental-elements-Groundwater

place. The site slopes gently to the south, and we expect the stormwater to be infiltrated before reaching the West Canal.

2. **Could waste materials enter ground or surface waters? If so, generally describe.**

   No waste materials can enter the ground or surface waters. A Spill Prevention, Control, and Countermeasure Plan will be authored and sealed by a Professional Engineer familiar with 40 CFR Part 112. Each engine enclosure is equipped with internal containment to prevent material from leaving the enclosure. Any other materials stored outside will be handled in accordance with 40 CFR Part 112 and VoltaGrid's Waste Management Policy.

3. **Does the proposal alter or otherwise affect drainage patterns in the vicinity of the site? If so, describe.**

   Project will not alter or affect drainage patterns currently in place or utilized by GCPUD.

d. **Proposed measures to reduce or control surface, ground, and runoff water, and drainage pattern impacts, if any:**

   Ground is flat and covered with crushed rock/gravel. No additional construction activity will impact site conditions.

4. Plants

Find help answering plants questions

a. **Check the types of vegetation found on the site: Not applicable – ground is covered with crushed rock.**

   ☐ **deciduous tree: alder, maple, aspen, other**

   ☐ **evergreen tree: fir, cedar, pine, other**

   ☐ **shrubs**

   ☐ **grass**

   ☐ **pasture**

   ☐ **crop or grain**

   ☐ **orchards, vineyards, or other permanent crops.**

   ☐ **wet soil plants: cattail, buttercup, bullrush, skunk cabbage, other**

   ☐ **water plants: water lily, eelgrass, milfoil, other**

   ☐ **other types of vegetation**

b. **What kind and amount of vegetation will be removed or altered?**

   None – site is already covered with crushed rock/gravel.

c. **List threatened and endangered species known to be on or near the site.**

   There are no threatened or endangered species known to be on or near the sites.

d. Proposed landscaping, use of native plants, or other measures to preserve or enhance vegetation on the site, if any.

No proposed landscaping. Site has already been cleared and covered under GCPUD's Quincy Foothills Substation SEPA. VoltaGrid will occupy surface covered with crushed rock/gravel.

e. List all noxious weeds and invasive species known to be on or near the site.

Ground is covered with crushed rock/gravel. Any noxious weeds will be cleared for site housekeeping purposes.

5. Animals

Find help answering animal questions[8]

a. List any birds and other animals that have been observed on or near the site or are known to be on or near the site.

Examples include:

- **Birds: hawk, heron, eagle, songbirds, other:**
- **Mammals: deer, bear, elk, beaver, other:**
- **Fish: bass, salmon, trout, herring, shellfish, other:**

b. List any threatened and endangered species known to be on or near the site.

There are no threatened and/or endangered species known to be on or near the site.

c. Is the site part of a migration route? If so, explain.

Location is part of Pacific Flyway for migratory birds.

d. Proposed measures to preserve or enhance wildlife, if any.

No measures proposed. Wildlife will not be impacted by the project. Project area is already cleared and covered under GCPUD Quincy Foothills Substation SEPA.

e. List any invasive animal species known to be on or near the site.

There are no invasive animal species known to be on or near the site.

6. Energy and natural resources

Find help answering energy and natural resource questions[9]

a. What kinds of energy (electric, natural gas, oil, wood stove, solar) will be used to meet the completed project's energy needs? Describe whether it will be used for heating, manufacturing, etc.

[8] https://ecology.wa.gov/Regulations-Permits/SEPA/Environmental-review/SEPA-guidance/SEPA-checklist-guidance/SEPA-Checklist-Section-B-Environmental-elements/Environmental-elements-5-Animals
[9] https://ecology.wa.gov/Regulations-Permits/SEPA/Environmental-review/SEPA-guidance/SEPA-checklist-guidance/SEPA-Checklist-Section-B-Environmental-elements/Environmental-elements-6-Energy-natural-resou

Compressed natural gas will be brought onsite and used as fuel for natural gas engines. The engines will drive coupled generators to supplement the power grid for data center.

b. Would your project affect the potential use of solar energy by adjacent properties? If so, generally describe.

No.

c. What kinds of energy conservation features are included in the plans of this proposal? List other proposed measures to reduce or control energy impacts, if any.

Engines proposed for this project are lean burn natural gas engines, which are more efficient than rich burn. Lean burn offers lower fuel consumption and higher overall efficiency due to their higher air-fuel ratios, which leads to lower combustion temperatures and less wasted heat.

7. Environmental health

Health Find help with answering environmental health questions[10]

a. Are there any environmental health hazards, including exposure to toxic chemicals, risk of fire and explosion, spill, or hazardous waste, that could occur because of this proposal? If so, describe.

Criteria and hazardous air pollutants associated with natural gas combustion will be emitted from the engines. These pollutants are reduced as the raw exhaust is treated by a selective catalytic reduction and oxidation catalyst system.

There is a small chance of fire associated with the engine. This would be due to a fluid (lubricating oil or engine coolant) leak or cleaner being sprayed on the engine during operation. Surface of the engine would cause ignition of the fluid. Fire eyes and other detection systems are installed in the engine compartment to shut down the engine.

VoltaGrid has a waste management program to outline handling waste generated onsite. This waste would consist of empty clear bottles and cans, used oil, and general waste (towels, rags, food containers, etc.).

Each operational engine will utilize ~2.5 gallons of urea per hour to reduce NOx emissions in the exhaust. Urea is commonly used in many applications in agriculture (as a fertilizer) and medically (as a topical emollient and moisturizer).

Each engine will use for operation 202 gallons of engine oil and 52 gallons of gearbox oil. Engine oil will be checked daily and filled as needed per manufacturer specifications. After approximately 6 months of operation, the engine oil will be drained and replaced with new oil. Used oil will be collected by an approved disposal resourced and handled in accordance with appropriate rules and regulations.

[10] https://ecology.wa.gov/Regulations-Permits/SEPA/Environmental-review/SEPA-guidance/SEPA-checklist-guidance/SEPA-Checklist-Section-B-Environmental-elements/Environmental-elements-7-Environmental-health

1. **Describe any known or possible contamination at the site from present or past uses.**

   There is no known contamination at the site.

2. **Describe existing hazardous chemicals/conditions that might affect project development and design. This includes underground hazardous liquid and gas transmission pipelines located within the project area and in the vicinity.**

   There are no hazardous chemicals/conditions that will impact the project area. VoltaGrid project has been proposed away from the highway and substation.

3. **Describe any toxic or hazardous chemicals that might be stored, used, or produced during the project's development or construction, or at any time during the operating life of the project.**

   Project construction will require the use of heavy duty equipment, such as cranes and semi tractors. Fuels and lubricants will be used to normally operate this equipment. Normal operation of the engine will require engine coolant, lubricating and engine oils, and grease. All used oils and lubricants will either be consumed or recycled, and will be handled in accordance with VoltaGrid's waste management program.

4. **Describe special emergency services that might be required.**

   City of Quincy fire department. No other special emergency services are expected to be required.

5. **Proposed measures to reduce or control environmental health hazards, if any.**

   VoltaGrid will utilize the waste management program and site specific Spill Prevention, Control and Countermeasure plan to outline measures to reduce and control environmental hazards. Washington Department of Ecology's issued air permit will outline the measures and requirements VoltaGrid will follow to demonstrate compliance with air pollutants.

b. Noise

1. **What types of noise exist in the area which may affect your project (for example: traffic, equipment, operation, other)?**

   There are no known existing noise issues within the project area.

2. **What types and levels of noise would be created by or associated with the project on a short-term or a long-term basis (for example: traffic, construction, operation, other)? Indicate what hours noise would come from the site)?**

   Engine noise will not exceed 70 dBA at adjacent industrial zoned areas.

3. **Proposed measures to reduce or control noise impacts, if any:**

   The engines are surrounded by an enclosure with noise attenuation on the exhaust.

8. Land and shoreline use

Find help answering land and shoreline use questions[11]

a. What is the current use of the site and adjacent properties? Will the proposal affect current land uses on nearby or adjacent properties? If so, describe.

The proposed site has been cleared and covered with crushed rock/gravel under GCPUD's Quincy Foothills Substation project. GC PUD substation is adjacent and operating. There are also several data center facilities across Road O NW.

b. Has the project site been used as working farmlands or working forest lands? If so, describe. How much agricultural or forest land of long-term commercial significance will be converted to other uses because of the proposal, if any? If resource lands have not been designated, how many acres in farmland or forest land tax status will be converted to nonfarm or nonforest use?

The proposed parcel was once farmland but has since been re-zoned as "industrial". The proposed site has been cleared and covered with crushed rock/gravel under QCPUD's Quincy Foothills Substation. Site was used for construction activity and/or laydown.

1. **Will the proposal affect or be affected by surrounding working farm or forest land normal business operations, such as oversize equipment access, the application of pesticides, tilling, and harvesting? If so, how?**

   The project will not affect or be affected by surrounding working farm or forest land normal business operations.

c. Describe any structures on the site.

There are no structures on the site.

d. Will any structures be demolished? If so, what?

No structures will be demolished.

e. What is the current zoning classification of the site?

Industrial

f. What is the current comprehensive plan designation of the site?

Industrial

g. If applicable, what is the current shoreline master program designation of the site?

Not applicable

h. Has any part of the site been classified as a critical area by the city or county? If so, specify.

Yes, the site has been classified as a critical area by the county. According to the Gant County Interactive Map resource (All Purpose Grant County Map - Interactive | Open

[11] https://ecology.wa.gov/Regulations-Permits/SEPA/Environmental-review/SEPA-guidance/SEPA-checklist-guidance/SEPA-Checklist-Section-B-Environmental-elements/Environmental-elements-8-Land-shoreline-use

GIS Data - Grant County, Washington) this location, as is most of Grant County, is marked as Geologically Hazardous Area.

i. Approximately how many people would reside or work in the completed project?

Normally three (3) operations personnel will be onsite working a 12-hour shift. Periodically there will be 4-5 additional employees there during daylight hours.

j. Approximately how many people would the completed project displace?

None.

k. Proposed measures to avoid or reduce displacement impacts, if any.

Not applicable.

l. Proposed measures to ensure the proposal is compatible with existing and projected land uses and plans, if any.

Current zoning for area is City – Industrial. Proposed plan and use meets the current zoning and land use plan for industrial.

m. Proposed measures to reduce or control impacts to agricultural and forest lands of long-term commercial significance, if any:

Not applicable.

9. Housing

Find help answering housing questions[12]

a. Approximately how many units would be provided, if any? Indicate whether high, middle, or low-income housing.

Not applicable.

b. Approximately how many units, if any, would be eliminated? Indicate whether high, middle, or low-income housing.

Not Applicable

c. Proposed measures to reduce or control housing impacts, if any:

Not applicable

10. Aesthetics

Find help answering aesthetics questions[13]

a. What is the tallest height of any proposed structure(s), not including antennas; what is the principal exterior building material(s) proposed?

Structures that house the engines, exhaust treatment, cooling and silencing systems are rectangles (L x W x H) – 60 feet x 13 feet x 25 feet (18 meters x 4 meters x 7.6 meters).

[12] https://ecology.wa.gov/Regulations-Permits/SEPA/Environmental-review/SEPA-guidance/SEPA-checklist-guidance/SEPA-Checklist-Section-B-Environmental-elements/Environmental-elements-9-Housing
[13] https://ecology.wa.gov/Regulations-Permits/SEPA/Environmental-review/SEPA-guidance/SEPA-checklist-guidance/SEPA-Checklist-Section-B-Environmental-elements/Environmental-elements-10-Aesthetics

Engine enclosures are white tarp material with a VoltaGrid logo. Exhaust control structures are a metal I-beam with matte silver exhaust control equipment fixed to it.

b. What views in the immediate vicinity would be altered or obstructed?

Views blocked by the project will be data centers to the west and substation to the north. There is open field and access roads to the south. Farmland to the east.

c. Proposed measures to reduce or control aesthetic impacts, if any:

There are not proposed measures as the structures that will be blocked are industrial structures associated with the substation or data centers.

11. Light and glare

Find help answering light and glare questions[14]

a. What type of light or glare will the proposal produce? What time of day would it mainly occur?

LED lights are located on the outside of the engine enclosures. These are required so workers can safely access and maintain the equipment during evening hours. Lights will be aimed down to minimize impacts to surrounding areas.

b. Could light or glare from the finished project be a safety hazard or interfere with views?

Unlikely as lights required for safe operation of the equipment will be aimed toward the ground or work area. Surfaces will be matte to reduce glare. This is an industrial area and potential impacts to motorists, residents, etc., is not anticipated.

c. What existing off-site sources of light or glare may affect your proposal?

There are no offsite sources of light that will impact operation at the location.

d. Proposed measures to reduce or control light and glare impacts, if any:

Lights will be aimed toward the ground and working areas. Surfaces will be matte to reduce glare.

12. Recreation

Find help answering recreation questions

a. What designated and informal recreational opportunities are in the immediate vicinity?

There are no designated or informal recreation opportunities in the immediate vicinity.

b. Would the proposed project displace any existing recreational uses? If so, describe.

Proposed project will not displace any existing recreational uses.

[14] https://ecology.wa.gov/Regulations-Permits/SEPA/Environmental-review/SEPA-guidance/SEPA-checklist-guidance/SEPA-Checklist-Section-B-Environmental-elements/Environmental-elements-11-Light-glare

c. Proposed measures to reduce or control impacts on recreation, including recreation opportunities to be provided by the project or applicant, if any:

There are no recreation opportunities that will be displaced due to the project or created as part of the project.

13. Historic and cultural preservation

Find help answering historic and cultural preservation questions[15]

a. Are there any buildings, structures, or sites, located on or near the site that are over 45 years old listed in or eligible for listing in national, state, or local preservation registers? If so, specifically describe.

b. Both the Columbia Basin Project (CBP) West Canal and the CBP West Canal Road 0 NW Bridge are located 0.4 miles south of the southern edge of the proposed project boundary. The CPB West Canal has been determined eligible for listing on the NRHP (Fortin 2016). The CBP West Canal Road 0 NW Bridge has been determined eligible for listing on the NRHP, asl well as being a contributing element to the eligibility of the CBP West Canal (Fortin 2016). The nearest cultural resource to the proposed project boundary eligible for listing on the Washington Heritage Resister is St. Paul's German Lutheran Church in Quincy, located 2.5 miles east-southeast of the southern edge of the proposed project boundary (Pilliar 2012). Adjacent to St. Paul's German Lutheran Church is the Samuel and Katherine Reiman House, Eligible for listing on the Washington Heritage Resister and the NRHP (Pilliar 2008).

Based on GC PUD's cultural resource research, no historic buildings, structures or sites are located on or near the site boundaries. The nearest archeological site with a recommendation of eligibility for the National Register of Historic Places (NRHP) is 45GR371, a precontact lithic scatter (Chatters 1979), located 3.3 miles west-northwest of the northwest edge of the proposed project boundary. The Washington State Department of Archaeology and Historic Preservation have not issued a determination of eligibility for this site.

Chatters, James C.

1979 Master Site File for 45GR371. Manuscript on file, Washington State Department of Archaeology and Historic Preservation, Olympia.

Fortin, Louis W.

2016 Zayo Fiber Optics Project, Eastern Washington and Oregon Cultural Resource Survey. Plateau Archaeological Investigations, LLC. Prepared for Zayo Group, Pasco, Washington. Manuscript on file, Washington State Department of Archaeology and Historic Preservation, Olympia.

[15] https://ecology.wa.gov/Regulations-Permits/SEPA/Environmental-review/SEPA-guidance/SEPA-checklist-guidance/SEPA-Checklist-Section-B-Environmental-elements/Environmental-elements-13-Historic-cultural-p

Pilliar, Garland H.

2008 National Register of Historic Places Registration Form for Samuel and Katherine Reiman Houst. Manuscript on file, Washington State Department of Archaeology and Historic Preservation, Olympia.

2012 Washington Heritage Register Form for St. Paul's German Lutheran Church. Manuscript on file, Washington State Department of Archaeology and Historic Preservation, Olympia.

c. Are there any landmarks, features, or other evidence of Indian or historic use or occupation? This may include human burials or old cemeteries. Are there any material evidence, artifacts, or areas of cultural importance on or near the site? Please list any professional studies conducted at the site to identify such resources.

Based on GCPUD's cultural resources research, no cultural resources have been located and identified in the proposed project boundary. The nearest archaeological site to the proposed project boundary as shown in the Washington State Department of Archaeology and Historic Preservation's Washington Information System for Architectural and Archaeological Records Data (WISAARD) data base is 45GR3501 (Sloma 2016), an historic refuse scatter associated with an historic homestead, located 1.9 miles west of the southern edge of the proposed project boundary. The nearest precontact archaeological site is 45GR371 (Chatters 1979), a precontact lithic scatter, located 3.3 miles west-northwest of the northwest edge of the proposed project boundary. A determination of eligibility has not yet been made for this site. DAHP's predictive model layer shows the proposed project area to be of moderately low risk. As well, DAHP's WISAARD database shows that no subsurface or built environment properties eligible for the Washington Heritage Register or the National Register of Historic Places are located within the proposed project boundaries. One cultural resource survey overlaps with the proposed project area (Harder et al. 2019). Sediments encountered adjacent to the proposed project area in shovel proves excavated by Harder et al. (2019:19) included silt loams and sandy silt loams, with moderate refuse encountered at depths of up to 80 cmbs.

2019 Cultural Resource Survey for the Vantage Data Center Project, Grant County, Washington. Plateau Archaeological Investigations, LLC. Submitted to HITT Contracting, Inc. Manuscript on file, Washington State Department of Archaeology and Historic Preservation, Olympia.

Sloma, Robert A.

2016 State of Washington Archaeological Site Inventory Form for 45GR035001. Manuscript on file, Washington State Department of Archaeology and Historic Preservation, Olympia.

d. Describe the methods used to assess the potential impacts to cultural and historic resources on or near the project site. Examples include consultation with tribes and the department of archeology and historic preservation, archaeological surveys, historic maps, GIS data, etc.

Based on GCPUD's cultural resources research, methods include a review of records in the Washington State Department of Archaeology and Historic Preservation's Washington Information System for Architectural and Archaeological Records Data (WISAARD) database. Survey methods utilized by Harder et al. (2019) included pedestrian survey transects at a 20 meter interval in the area that overlaps with the west edge of the proposed project boundary.

e. Proposed measures to avoid, minimize, or compensate for loss, changes to, and disturbance to resources. Please include plans for the above and any permits that may be required.

The surface has already been cleared and covered with crushed rock/gravel.

Since VoltaGrid is leasing the surface from GCPUD we will follow their process:

In the event of an unanticipated discovery, VoltaGrid will:

1. Discontinue activity at the location.

2. Onsite supervisor will be immediately notified.

3. The work site will be secured from additional impacts and the onsite supervisor will notify VoltaGrid HSE and GCPUD onsite contact.

4. VoltaGrid and GCPUD will contact any agencies with jurisdiction over the lands where the discovery was located. The preferred course of action is for the project or ground disturbing action to be redesigned to avoid the newly identified site. Location will be treated as a new site and record it accordingly, unless the discovery can be reasonably associated or connected to a known site nearby.

State law (RCW 68.50 [Human Remains], RCW 27.44 [Indian Graves and Records], and RCW 68.60 [Abandoned and Historic Cemeteries and Historic Graves]) prevail on lands held in fee by VoltaGrid, GCPUD, a state agency, or private owners. The protocol for handling inadvertent discovery of human remains is subject to state law and follows the general guidelines for state and private lands listed below:

1. Any person engaging in ground disturbing activity that encounters skeletal human remains must cease all activity which may cause further disturbance to the remains, make a reasonable effort to protect the area frum further disturbance, report the presence and location of those remains to the corner and local law enforcement.
2. The county coroner will assume jurisdiction over the human skeletal remains and make a determination of whether those remains are forensic or non-forensic.
3. If the county coroner determines the remains are non-forensic, then the DAHP will take jurisdiction over the remains.
4. The State Physical Anthropologist will make a determination of whether the remains are American Indian or not and report the findings to the affected parties.

5. The DAHP will handle all consultation with the affected parties as to the future preservation, excavation and disposition of the remains if there is no federal agency involvement.

VoltaGrid, in conjunction with GCPUD's Cultural Resource Manager, will assist the County Coroner, law enforcement, and State Forensic Physical Anthropologist as requested through execution of the above protocol.

14. Transportation

Find help with answering transportation questions[16]

a. Identify public streets and highways serving the site or affected geographic area and describe proposed access to the existing street system. Show on site plans, if any.

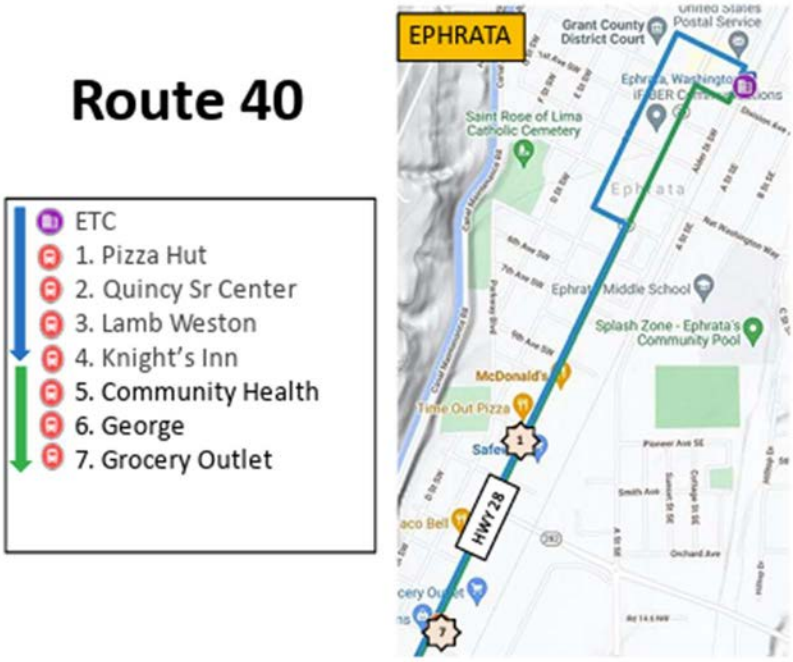
The project will take place off of Road O NW and Road 11 NW in Quincy, Washington. Access to the site is from Road O. Road O and Road 11 are paved roads. Highway access to Quincy is provided via State Highway 28 from the east and State Highway 281 from the South, both two lane highways.

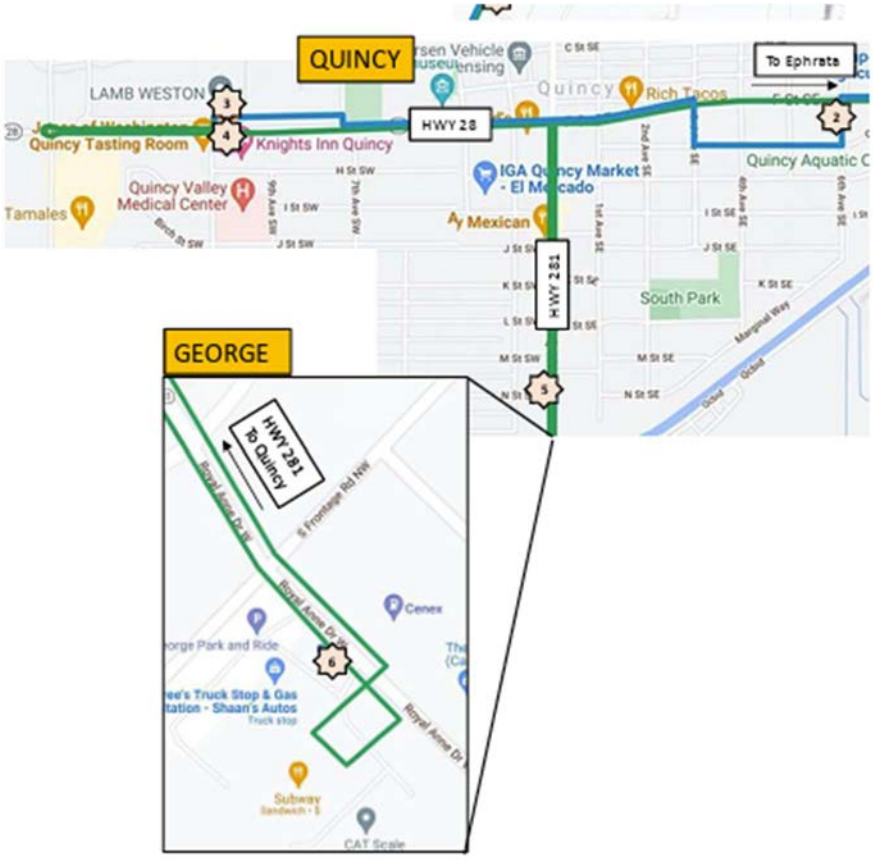
Trucks hauling CNG will utilize one of the following routes to bring CNG from Moses Lake to the project area (there will be no need to enter the Town of Quincy during normal operations):

b. Is the site or affected geographic area currently served by public transit? If so, generally describe. If not, what is the approximate distance to the nearest transit stop?

[16] https://ecology.wa.gov/Regulations-Permits/SEPA/Environmental-review/SEPA-guidance/SEPA-checklist-guidance/SEPA-Checklist-Section-B-Environmental-elements/Environmental-elements-14-Transportation

Grant County Transit Authority provides public transportation in this area. The closest route is located at the Quincy Senior Center, approximately 3 miles from the project location.





c. **Will the proposal require any new or improvements to existing roads, streets, pedestrian, bicycle, or state transportation facilities, not including driveways? If so, generally describe (indicate whether public or private).**

This project will not require any new construction or improvements to existing roads, streets, pedestrian, bicycle, or state transportation facilities.

d. **Will the project or proposal use (or occur in the immediate vicinity of) water, rail, or air transportation? If so, generally describe.**

The project will not use, or be, in the immediate vicinity of, water, rail or air transportation.

e. **How many vehicular trips per day would be generated by the completed project or proposal? If known, indicate when peak volumes would occur and what percentage of the volume would be trucks (such as commercial and nonpassenger vehicles). What data or transportation models were used to make these estimates?**

10 light duty vehicle trips to the location per day (24-hr) and 16 semi tractor trailer trips to the location per day (24-hr) during peak operation and 100% utilization of full buildout.

f. **Will the proposal interfere with, affect, or be affected by the movement of agricultural and forest products on roads or streets in the area? If so, generally describe.**

Project will not interfere with, affect, or be affected by the movement of agricultural and forest products access.

g. **Proposed measures to reduce or control transportation impacts, if any:**

The project will not have an impact on traffic in the area. VoltaGrid will not require travel through residential areas and will focus on traveling during daylight hours. Equipment brought to location will avoid main "through" streets. Surface is covered with crushed rock/gravel to keep soils from leaving location. Track-out control mats will be utilized as a best management practice as needed. Transportation route for CNG trucks is outlined above.

15. Public services

Find help answering public service questions[17]

a. **Would the project result in an increased need for public services (for example: fire protection, police protection, public transit, health care, schools, other)? If so, generally describe.**

There will be no need to increase public services for this project.

[17] https://ecology.wa.gov/regulations-permits/sepa/environmental-review/sepa-guidance/sepa-checklist-guidance/sepa-checklist-section-b-environmental-elements/environmental-elements-15-public-services

b. Proposed measures to reduce or control direct impacts on public services, if any.

16. Utilities

Find help answering utilities questions[18]

a. Circle utilities currently available at the site: electricity, natural gas, water, refuse service, telephone, sanitary sewer, septic system, other:

Highlighted services are nearby. VoltaGrid's usage of these services is being evaluated. Operations building is being designed to have a cistern and grey water tank. Trash generated will be general household type trash and either removed through municipal trash system or transported to Grant County Landfill by VoltaGrid employees. Recyclables will be separated and taken to Quincy Recycling Center.

b. Describe the utilities that are proposed for the project, the utility providing the service, and the general construction activities on the site or in the immediate vicinity which might be needed. VoltaGrid is providing for temporary power, water, and portable toilets to aid in construction activities. These utilities will be removed once construction is complete.

C.Signature

Find help about who should sign[19]

The above answers are true and complete to the best of my knowledge. I understand that the lead agency is relying on them to make its decision.

X 

Type name of signee: Korby Bracken

Position and agency/organization: Senior Director – Health, Safety & Environment

Date submitted: **9/16/2025 – Updated 11/13/2025**

D.Supplemental sheet for nonproject actions : Not applicable

Find help for the nonproject actions worksheet[20]

Do not use this section for project actions.

[18] https://ecology.wa.gov/regulations-permits/sepa/environmental-review/sepa-guidance/sepa-checklist-guidance/sepa-checklist-section-b-environmental-elements/environmental-elements-16-utilities
[19] https://ecology.wa.gov/Regulations-Permits/SEPA/Environmental-review/SEPA-guidance/SEPA-checklist-guidance/SEPA-Checklist-Section-C-Signature
[20] https://ecology.wa.gov/regulations-permits/sepa/environmental-review/sepa-guidance/sepa-checklist-guidance/sepa-checklist-section-d-non-project-actions

Because these questions are very general, it may be helpful to read them in conjunction with the list of the elements of the environment.

When answering these questions, be aware of the extent the proposal, or the types of activities likely to result from the proposal, would affect the item at a greater intensity or at a faster rate than if the proposal were not implemented. Respond briefly and in general terms.

1. **How would the proposal be likely to increase discharge to water; emissions to air; production, storage, or release of toxic or hazardous substances; or production of noise?**

    - **Proposed measures to avoid or reduce such increases are:**

2. **How would the proposal be likely to affect plants, animals, fish, or marine life?**

    - **Proposed measures to protect or conserve plants, animals, fish, or marine life are:**

3. **How would the proposal be likely to deplete energy or natural resources?**

    - **Proposed measures to protect or conserve energy and natural resources are:**

4. **How would the proposal be likely to use or affect environmentally sensitive areas or areas designated (or eligible or under study) for governmental protection, such as parks, wilderness, wild and scenic rivers, threatened or endangered species habitat, historic or cultural sites, wetlands, floodplains, or prime farmlands?**

    - **Proposed measures to protect such resources or to avoid or reduce impacts are:**

5. **How would the proposal be likely to affect land and shoreline use, including whether it would allow or encourage land or shoreline uses incompatible with existing plans?**

    - **Proposed measures to avoid or reduce shoreline and land use impacts are:**

6. **How would the proposal be likely to increase demands on transportation or public services and utilities?**

- **Proposed measures to reduce or respond to such demand(s) are:**

7. **Identify, if possible, whether the proposal may conflict with local, state, or federal laws or requirements for the protection of the environment.**

APPENDIX C
EMISSION ESTIMATES

Table 1. Site-wide Emission Summary

Project Emissions Summary: Short -Term Emissions (lb/hr - total) [1]							
Source	**Pollutant**						
	VOC	**NO_X**	**CO**	**SO_2**	**PM**	**PM_{10}**	**$PM_{2.5}$**
Jenbacher J620 Engines	6.1	10	24	1.4	1.4	1.4	1.4
MESA Solutions Black Start Emergency Engine	0.089	0.13	0.030	2.8E-03	0.092	0.092	0.092
Plant Roads (Unpaved)	--	--	--	--	0.6	0.15	0.015
Total Site-Wide Short-Term Emissions	6.1	10	24	1.4	2.1	1.7	1.53

Notes:

1. Total facility-wide short-term emissions include emissions from all J620 and BS engines and include all modes of operation (startup and steady state operation). Fugitive PM emissions from roads are also included.

Project Emissions Summary: Annual Emissions (tpy - total) [1]													
Source	**Pollutant**												
	VOC	**NO_X**	**CO**	**SO_2**	**PM**	**PM_{10}**	**$PM_{2.5}$**	**CO_2**	**CH_4**	**N_2O**	**CO_2e**	**Max. Single HAP Formaldehyde**	**Total HAPs**
Jenbacher J620 Engines	10	8.7	41	6.2	6.2	6.2	6.2	*186,699*	3.5	0.35	*186,891*	6.2	9.4
MESA Solutions Black Start Emergency Engine	4.4E-03	6.3E-03	1.5E-03	1.4E-04	4.6E-03	4.6E-03	4.6E-03	*41*	0.063	3.0E-03	*43*	4.9E-03	0.010
Plant Roads (Unpaved)	--	--	--	--	2.5	0.6	0.06	--	--	--	--	--	--
Total Site-Wide Annual Emissions	10	8.7	41	6.2	9	6.9	6.3	*186,740*	3.6	0.35	*186,934*	6.2	9.4
New Source Review (NSR) Major Source Thresholds [2]	*250*	*250*	*250*	*250*	*250*	*250*	*250*				*100,000*		
Below NSR Major Source Threshold?	YES	YES	YES	YES	YES	YES	YES				**NOTE (4)**		
Title V Major Source Threshold [3]	*100*	*100*	*100*	*100*	*100*	*100*	*100*					*10*	*25*
Below Title V Major Source Threshold?	YES	YES	YES	YES	YES	YES	YES					YES	YES

Notes:

1. Total facility-wide short-term emissions include emissions from all J620 and BS engines and include all modes of operation (startup and steady state operation). Fugitive PM emissions from roads are also included.
2. Major source New Source Review threshold is 250 tons/year per 40 CFR 52.21 and WAC 400-720. Facility-wide potential emissions are well below this threshold.
3. Title V major source threshold is 100 tons/year for any criteria pollutant (for sources located in attainment areas) or 10 tons/year for any single HAP or 25 tons/year for combined HAPs.
4. While the GHG emissions are above the major source threshold, USEPA's July 24, 2014 memo (https://www.epa.gov/sites/default/files/2015-08/documents/2014scotus.pdf) notes that PSD review cannot be triggered for GHGs alone.

Table 2. Jenbacher Engine Specifications and Vendor Emissions Data

Parameter	Units	Pre-Control Emissions (100% Load)	Pre-Control Emissions (75% Load)	Pre-Control Emissions (50% Load)	Control Device	Control Efficiency
Model		Jenbacher J620				
Number of Engines		14				
Generator Rating	MW	3				
Firing Rate[1]	hp	4,601	3,450	2,300		
Brake-Specific Fuel Consumption[1]	BTU/hp-hr	5,657	5,853	6,155		
Fuel Consumption[1]	scf/hr	28,383	22,024	15,437		
Actual Exhaust Flow[2]	acfm	20,050	16,241	11,848		
Exhaust Temperature[1]	deg F	682	783	891		
NO_X[3,4]	lb/hr per engine	7.0	5.8	3.9	SCR	98%
CO[3,4]	lb/hr per engine	13	8.0	5.9	Oxidation Catalyst	95%
VOC	lb/hr per engine	3.3	n/a	n/a	Oxidation Catalyst	95%
$PM/PM_{10}/PM_{2.5}$	lb/hr per engine	0.10	n/a	n/a	N/A	0%
SO_2	lb/hr per engine	0.10	n/a	n/a	N/A	0%
CH_2O	lb/hr per engine	2.0	n/a	n/a	Oxidation Catalyst	95%

Notes:

1. Firing Rate, Brake-Specific Fuel Consumption, and Exhaust Temperature are from the manufacturer's specification sheet.

2. Actual Exhaust Flow was calculated from the Standard Exhaust Flow as provided in the manufactuer's specification sheet.

3. CO and NO_x emission factors for 75% and 50% load operations are from the QSEDOK1 Test Certificate and are the maximum of two test runs.

4. Test data from the QSEDOK1 Test Certificate were provided for 51% and 75% loads.

Table 3. MESA Solutions Engine Specifications and Vendor Emissions Data

Parameter	Units	Controlled Emissions (100% Load)
Model		MESA Solutions GV22PU
Number of Engines		1
Generator Rating	kW	390
Firing Rate[1]	hp	684
Heat Input[1,2]	MMBtu/hr/engine	4.7
Actual Exhaust Flow[3]	acfm	2,338
Exhaust Temperature[3]	deg F	950
Annual Hours of Operation	hr/yr/engine	100
NO_X[4]	lb/hr per engine	0.13
CO[4]	lb/hr per engine	0.030
VOC[4]	lb/hr per engine	0.089
$PM/PM_{10}/PM_{2.5}$[5]	lb/MMBtu per engine	1.9E-02
SO_2[5]	lb/MMBtu per engine	5.9E-04

Notes:

1. Engine data provided by manufacturer.
2. The vendor provided a high heat value of natural gas of 1,041 Btu/scf.
3. Actual Exhaust Flow was calculated from the exhaust flow at the turbine outlet as provided in the manufacturer's specification sheet.
4. Emissions of VOC, CO, and NO_X are based on vendor emissions guarantees.
5. Emissions of PM and SO_2 are based on AP-42, Table 3.2-3 (Emission Factors for natural gas-fired four-stroke rich burn engines). The PM emissions include condensables.

Table 4. Jenbacher Potential Emission Calculations - Criteria Pollutants and Greenhouse Gases

Engine Specifications		
Emission Units	GEN-1, GEN-2, GEN-3, GEN-4, GEN-5, GEN-6, GEN-7, GEN-8, GEN-9, GEN-10, GEN-11, GEN-12, GEN-13, GEN-14	
Engine	Jenbacher J620	
Fuel Type	Natural Gas	
Engine Power[1]	4,601	HP
Heat Input[1]	26	MMBtu/hr/engine
Fuel Consumption[1]	5,657	BTU/hp-hr
Annual Hours of Operation	8,760	hr/yr/engine
Startup / Shutdown Events		
Number of Startups per Engine per Month	3	events/month/engine
Number of Shutdowns per Engine per Month	3	events/month/engine
Duration of Startup Event	5	minutes/event/engine[2]
Total time spent in startup mode per engine per month	0.25	hours/month/engine
Total time spent in startup mode per engine per year	3	hours/year/engine
Total time spend in normal operations mode	8,757	hours/year/engine
Total Number of Engines at the site[3]	14	engines

Notes:

1. Engine data provided by manufacturer.
2. While the calculations conservatively assume 0% control during the entire startup duration, the oxidation catalyst (which is a passive control device) will begin oxidizing organics and CO as the engine exhaust heats up the catalyst bed (well before the end of the 5 min startup period).
3. For the purposes of potential emissions calculations, VoltaGrid has assumed that all 14 engines are operated at the same at the worst-case load.

Criteria Pollutant Emissions (Per Engine)

Pollutant	Hourly Emissions Assuming 1 event (5 mins) of Startup and Remainder of Steady State Operations			Hourly Emissions Assuming 1 hour of Steady State Operation	Annual Emissions (per engine)		
	Startup (5 min)	Steady State (55 min)	Total[1]		Startup (3 hr/year/engine)	Steady State (8,757 hr/year/engine)	Total[2]
	lb/startup event	lb/SS	lb/hr	lb/hr	tpy	tpy	tpy
VOC	0.28	0.15	0.43	0.167	5.0E-03	0.73	0.74
NO_x	0.6	0.13	0.7	0.14	0.010	0.61	0.62
CO	1.1	0.61	1.7	0.66	0.020	2.9	2.9
$PM/PM_{10}/PM_{2.5}$	8.45E-03	0.09	0.10	0.10	1.5E-04	0.44	0.44
SO_2	8.45E-03	0.09	0.101	0.101	1.5E-04	0.44	0.44

Notes:

1. Short-term (hourly) emissions are calculated assuming one 5-minute startup event occurs during an hour.
2. Annual emissions are calculated assuming 36 5-minute startup events occur during a year.

Table 4. Jenbacher Potential Emission Calculations - Criteria Pollutants and Greenhouse Gases

Criteria Pollutant Emissions (Total for All Engines)

Pollutant	Hourly Emissions Including 1 event (5 mins) of Startup and Remainder of Steady State Operations			Hourly Emissions Assuming 1 hour of Steady State Operation	Annual Emissions (total for all engines)		
	Startup (5 min)	Steady State (55 min)	Total[1]		Startup (3 hr/year/engine)	Steady State (8,757 hr/year/engine)	Total [2,3]
	lb/startup event	lb/SS	lb/hr	lb/hr	tpy	tpy	tpy
VOC	3.9	2.15	6.1	2.34	0.07	10.3	10.3
NO_x	8	1.8	10	2.0	0.15	8.6	8.7
CO	16	8.5	24	9.3	0.3	41	41
$PM/PM_{10}/PM_{2.5}$	0.12	1.30	1.4	1.4	2.1E-03	6.2	6.2
SO_2	0.12	1.30	1.42	1.42	2.1E-03	6.2	6.2

Notes:

1. Short-term (hourly) emissions are calculated assuming one 5-minute startup event occurs during an hour.
2. Annual emissions are calculated assuming 36 5-minute startup events occur during a year.
3. Total emissions for all the engines proposed at the facility are calculated as follows:
   Short-term emissions (lb/hr - total) = Short-term emissions (lb/hr/engine) * (number of engines)
   Annual emissions (tpy - total) = Annual emissions (tpy per engine) * (number of engines)

Table 4. Jenbacher Potential Emission Calculations - Criteria Pollutants and Greenhouse Gases

Greenhouse Gas (GHG) Emissions

Pollutant	Emission Factor[1] (lb/MMBtu)
CO_2	116.98
CH_4	2.2E-03
N_2O	2.2E-04
CO_2e^2	117.10

Notes:

1. Per 40 CFR 98, Subpart C, Tables C-1 and C-2 for natural gas combustion. The emission factors were converted from kg/MMBtu to lb/MMBtu.

2. The carbon dioxide equivalent (CO_2e) emission factor is calculated as the sum of each GHG pollutant multiplied by its global warming potential.

   Global warming potentials are based on 40 CFR 98, Subpart A, Table A-1:

   CO_2: 1
   CH_4: 28
   N_2O: 265

Pollutant	Emission Factor [1]	Emissions per Engine		Total Emissions for all Engines	
		lb/hr	tpy	lb/hr	tpy
CO_2	116.98 lb/MMBtu	3,045	13,336	42,625	186,699
CH_4	0.0022 lb/MMBtu	0.057	0.25	0.80	3.5
N_2O	0.00022 lb/MMBtu	0.0057	0.025	0.080	0.35
CO_2e^2	117.10 lb/MMBtu	3,048	13,349	42,669	186,891

Notes:

1. Per 40 CFR 98, Subpart C, Tables C-1 and C-2 for natural gas combustion. The emission factors were converted from kg/MMBtu to lb/MMBtu.

2. The carbon dioxide equivalent (CO_2e) emission factor is calculated as the sum of each GHG pollutant multiplied by its global warming potential.

   Global warming potentials are based on 40 CFR 98, Subpart A, Table A-1:

Table 5. Jenbacher Potential Emission Calculations - Hazardous and Toxic Air Pollutants

Engine Specifications		
Emission Units	GEN-1, GEN-2, GEN-3, GEN-4, GEN-5, GEN-6, GEN-7, GEN-8, GEN-9, GEN-10, GEN-11, GEN-12, GEN-13, GEN-14	
Engine	Jenbacher J620	
Fuel Type	Natural Gas	
Engine Power[1]	4,601	HP
Heat Input[1]	26	MMBtu/hr/engine
Fuel Consumption[1]	5,657	BTU/hp-hr
Annual Hours of Operation	8,760	hr/yr/engine
Control Efficiency	90%	Assumption based on VOC control efficiency being 95%
Startup / Shutdown Events		
Number of Startups per Engine per Month	3	events/month/engine
Number of Shutdowns per Engine per Month	3	events/month/engine
Duration of Startup Event	5	minutes/event/engine[2]
Startup Events per Day	1	startup/day
Total time spent in startup mode per engine per month	0.25	hours/month/engine
Total time spent in startup mode per engine per year	3	hours/year/engine
Total time spent in normal operations mode	8,757	hours/year/engine
Total Number of Engines at the site[3]	14	engines

Notes:

1. Engine data provided by manufacturer.
2. While the calculations conservatively assume 0% control during the entire startup duration, the oxidation catalyst (which is a passive control device) will begin oxidizing organics and CO as the engine exhaust heats up the catalyst bed (well before the end of the 5 min startup period).
3. For the purposes of potential emissions calculations, VoltaGrid has assumed that all 14 engines are operated at the same at the worst-case load.

Table 5. Jenbacher Potential Emission Calculations - Hazardous and Toxic Air Pollutants

Toxic Air Pollutant Emissions

Pollutant	Maximum Emission Factor[1]	Startup Emissions (per engine)	Steady State Emissions (per engine)[2]	Peak Emissions Per Engine			Peak Emissions All Engines[6]		
				Hourly With 1 Startup Event in that Hour[3]	Daily With 1 Startup Event per Day[4]	Annual With 36 Startup Events per Year[5]	Hourly With 1 Startup Event in that Hour[3]	Daily With 1 Startup Event per Day[4]	Annual With 36 Startup Events per Year[5]
	lb/MMBtu	lb/startup event	lb/hr	lb/hr	lb/day	tpy	lb/hr	lb/day	tpy
Primary NO_2[7]	0.027	0.06	0.014	0.07	0.39	0.062	1.0	5.5	0.86
CO	0.51	1.1	0.66	1.7	17	2.9	24.03	238	41
SO_2	3.9E-03	8.453E-03	0.101	0.101	2.4	0.44	1.42	34	6.2
NH_3[8]	5.0 ppmv	--	0.25	0.25	6.0	1.1	3.5	85	15
1,1,2,2-Tetrachloroethane	4.0E-05	8.7E-05	1.0E-04	1.8E-04	2.6E-03	4.6E-04	2.6E-03	0.036	6.4E-03
1,1,2-Trichloroethane	3.2E-05	6.9E-05	8.3E-05	1.4E-04	2.0E-03	3.6E-04	2.0E-03	0.029	5.1E-03
1,1-Dichloroethane	2.4E-05	5.1E-05	6.1E-05	1.1E-04	1.5E-03	2.7E-04	1.5E-03	0.021	3.8E-03
1,2,3-Trimethylbenzene	2.3E-05	5.0E-05	6.0E-05	1.0E-04	1.5E-03	2.6E-04	1.5E-03	0.021	3.7E-03
1,2,4-Trimethylbenzene	1.4E-05	3.1E-05	3.7E-05	6.5E-05	9.2E-04	1.6E-04	9.1E-04	0.013	2.3E-03
1,2-Dichloroethane	2.4E-05	5.1E-05	6.1E-05	1.1E-04	1.5E-03	2.7E-04	1.5E-03	0.021	3.8E-03
1,2-Dichloropropane	2.7E-05	5.8E-05	7.0E-05	1.2E-04	1.7E-03	3.1E-04	1.7E-03	0.024	4.3E-03
1,3,5-Trimethylbenzene	3.4E-05	7.3E-05	8.8E-05	1.5E-04	2.2E-03	3.9E-04	2.2E-03	0.030	5.4E-03
1,3-Butadiene	3.6E-04	7.7E-04	9.3E-04	1.6E-03	0.023	4.1E-03	0.023	0.32	0.057
1,3-Dichloropropene	2.6E-05	5.7E-05	6.9E-05	1.2E-04	1.7E-03	3.0E-04	1.7E-03	0.024	4.2E-03
2-Methylnaphthalene	3.3E-05	7.2E-05	8.6E-05	1.5E-04	2.1E-03	3.8E-04	2.1E-03	0.030	5.3E-03
2,2,4-Trimethylpentane	2.5E-04	5.4E-04	6.5E-04	1.1E-03	0.016	2.9E-03	0.016	0.23	0.040
Acenaphthene	1.3E-06	2.7E-06	3.3E-06	5.7E-06	8.1E-05	1.4E-05	8.0E-05	1.1E-03	2.0E-04
Acenaphthylene	5.5E-06	1.2E-05	1.4E-05	2.5E-05	3.6E-04	6.3E-05	3.5E-04	5.0E-03	8.8E-04
Acetaldehyde	8.4E-03	0.018	0.022	0.038	0.54	0.10	0.5	7.5	1.3
Acrolein	5.1E-03	0.011	0.013	0.023	0.33	0.059	0.33	4.6	0.82
Anthracene	1.2E-07	2.5E-07	3.0E-07	5.3E-07	7.5E-06	1.3E-06	7.4E-06	1.0E-04	1.8E-05
Benz(a)anthracene	5.7E-08	1.2E-07	1.5E-07	2.6E-07	3.7E-06	6.5E-07	3.7E-06	5.2E-05	9.2E-06
Benzene	4.4E-04	9.5E-04	1.1E-03	2.0E-03	0.028	5.0E-03	0.028	0.40	0.070
Benzo(a)pyrene	2.6E-09	5.7E-09	6.8E-09	1.2E-08	1.7E-07	3.0E-08	1.7E-07	2.4E-06	4.2E-07
Benzo(b)fluoranthene	1.7E-07	3.6E-07	4.3E-07	7.6E-07	1.1E-05	1.9E-06	1.1E-05	1.5E-04	2.7E-05
Benzo(e)pyrene	4.2E-07	9.0E-07	1.1E-06	1.9E-06	2.7E-05	4.7E-06	2.6E-05	3.7E-04	6.6E-05
Benzo(g,h,i)perylene	4.1E-07	9.0E-07	1.1E-06	1.9E-06	2.7E-05	4.7E-06	2.6E-05	3.7E-04	6.6E-05
Benzo(k)fluoranthene	7.6E-09	1.7E-08	2.0E-08	3.5E-08	4.9E-07	8.7E-08	4.9E-07	6.9E-06	1.2E-06
Biphenyl	2.1E-04	4.6E-04	5.5E-04	9.7E-04	0.014	2.4E-03	0.014	0.19	0.034
Butane	5.4E-04	1.2E-03	1.4E-03	2.5E-03	0.035	6.2E-03	0.034	0.49	0.086
Butyr/Isobutyraldehyde	1.0E-04	2.2E-04	2.6E-04	4.6E-04	6.5E-03	1.2E-03	6.441E-03	0.09	0.016
Carbon Tetrachloride	3.7E-05	8.0E-05	9.6E-05	1.7E-04	2.4E-03	4.2E-04	2.3E-03	0.033	5.9E-03
Chlorobenzene	3.1E-05	6.6E-05	7.9E-05	1.4E-04	2.0E-03	3.5E-04	1.9E-03	0.028	4.9E-03
Chloroethane	1.9E-06	4.1E-06	4.9E-06	8.5E-06	1.2E-04	2.1E-05	1.2E-04	1.7E-03	3.0E-04
Chloroform	2.9E-05	6.2E-05	7.4E-05	1.3E-04	1.8E-03	3.3E-04	1.8E-03	0.026	4.6E-03
Chrysene	6.9E-07	1.5E-06	1.8E-06	3.2E-06	4.5E-05	7.9E-06	4.4E-05	6.2E-04	1.1E-04
Cyclopentane	2.3E-04	4.9E-04	5.9E-04	1.0E-03	0.015	2.6E-03	0.014	0.20	0.036
Ethane	0.11	0.23	0.27	0.5	6.8	1.2	7	95	17
Ethylbenzene	6.9E-05	1.5E-04	1.8E-04	3.2E-04	4.5E-03	7.9E-04	4.421E-03	0.063	0.011
Ethylene Dibromide	4.4E-05	9.6E-05	1.2E-04	2.0E-04	2.9E-03	5.1E-04	2.8E-03	0.040	7.1E-03
Fluoranthene	1.1E-06	2.4E-06	2.9E-06	5.1E-06	7.2E-05	1.3E-05	7.1E-05	1.0E-03	1.8E-04
Fluorene	5.7E-06	1.2E-05	1.5E-05	2.6E-05	3.7E-04	6.5E-05	3.6E-04	5.1E-03	9.1E-04
Formaldehyde	0.078	0.17	0.10	0.26	2.6	0.44	4	36	6.2
Indeno(1,2,3-c,d)pyrene	7.0E-09	1.5E-08	1.8E-08	3.2E-08	4.5E-07	8.0E-08	4.5E-07	6.3E-06	1.1E-06
Methanol	2.5E-03	5.422E-03	6.5E-03	0.011	0.16	0.029	0.16	2.3	0.40
Methylene Chloride	2.0E-05	4.3E-05	5.2E-05	9.1E-05	1.3E-03	2.3E-04	1.3E-03	0.018	3.2E-03
n-Hexane	1.1E-03	2.408E-03	2.9E-03	5.056E-03	0.072	0.013	0.07	1.0	0.18
n-Nonane	1.1E-04	2.4E-04	2.9E-04	5.0E-04	7.1E-03	1.3E-03	7.015E-03	0.10	0.018
n-Octane	3.5E-04	7.6E-04	9.1E-04	1.6E-03	0.023	4.0E-03	0.022	0.32	0.056
n-Pentane	2.6E-03	5.639E-03	6.8E-03	0.012	0.17	0.030	0.17	2.3	0.42
Naphthalene	7.4E-05	1.6E-04	1.9E-04	3.4E-04	4.8E-03	8.5E-04	4.744E-03	0.067	0.012
PAH	2.7E-05	5.8E-05	7.0E-05	1.2E-04	1.7E-03	3.1E-04	1.7E-03	0.024	4.3E-03
Perchloroethylene	2.5E-06	5.4E-06	6.5E-06	1.1E-05	1.6E-04	2.8E-05	1.6E-04	2.2E-03	4.0E-04
Phenanthrene	1.0E-05	2.3E-05	2.7E-05	4.7E-05	6.7E-04	1.2E-04	6.6E-04	0.009	1.7E-03
Phenol	2.4E-05	5.2E-05	6.2E-05	1.1E-04	1.5E-03	2.7E-04	1.5E-03	0.022	3.8E-03
Propane	0.042	0.09	0.11	0.19	2.7	0.48	2.7	38	6.7
Pyrene	1.4E-06	2.9E-06	3.5E-06	6.2E-06	8.8E-05	1.6E-05	8.7E-05	1.2E-03	2.2E-04
Styrene	2.4E-05	5.1E-05	6.1E-05	1.1E-04	1.5E-03	2.7E-04	1.5E-03	0.021	3.8E-03
Toluene	4.1E-04	8.8E-04	1.1E-03	1.9E-03	0.026	4.7E-03	0.026	0.37	0.065
Vinyl Chloride	1.5E-05	3.2E-05	3.9E-05	6.8E-05	9.6E-04	1.7E-04	9.5E-04	0.013	2.4E-03
Xylenes	6.3E-04	1.4E-03	1.6E-03	2.9E-03	0.0	7.2E-03	0.04	0.57	0.10
Dibenz(a,h)anthracene	2.6E-09	5.7E-09	6.8E-09	1.2E-08	1.7E-07	3.0E-08	1.7E-07	2.4E-06	4.2E-07
Propylene	5.2E-03	0.011	0.014	0.024	0.34	0.060	0.33	4.7	0.84
TOTAL HAPs				**0.35**	**3.9**	**0.67**	**5**	**54**	**9.4**

Table 5. Jenbacher Potential Emission Calculations - Hazardous and Toxic Air Pollutants

Notes:

1. Maximum emission factors are taken between AP-42 and CATEF. Maximum emission factors for Primary NO_2, CO, SO_2, and Formaldehyde are provided by the manufacturer.

2. Formaldehyde is controlled by 95% per vendor specification. To be conservative, all other toxics are assumed to be controlled by 90%.
3. Short-term (hourly) emissions are calculated assuming one 5-minute startup event occurs during an hour.
4. Daily emissions are calculated assuming one 5-minute startup event occurs during a day.
5. Annual emissions are calculated assuming 36 5-minute startup events occur during a year.
6. Total emissions for all the engines proposed at the facility are calculated as follows:
   Short-term emissions (lb/hr - total) = Short-term emissions (lb/hr/engine) * (number of engines)
   Annual emissions (tpy - total) = Annual emissions (tpy per engine) * (number of engines)
7. NO_2 emissions are assumed 10% of NO_x emissions.
8. Ammonia slip data provided by the manufacturer. Peak ammonia emissions conservatively assume no startup events occur during the emission period.
   Ammonia emissions for each engine proposed at the facility are calculated as follows:
   Short term emissions (lb/hr/engine) = (NH3 Slip [ppmv] / 10^6) * (1 / Molar Vol. of Flue Gas [scf/lb-mol]) * MW of NH3 [lb/lb-mol] * Flue Gas Flow Rate [acfm] * 60 [min/hr]
   Annual emissions (tpy per engine) = Short term emissions (lb/hr/engine) * 8760 [hr/day] / 2000 [lb/ton]
   Short-term emissions (lb/hr - total) = Short-term emissions (lb/hr/engine) * (number of engines)
   Annual emissions (tpy - total) = Annual emissions (tpy per engine) * (number of engines)

Table 6. Potential Emission Calculations - Criteria Pollutants and Greenhouse Gases from the MESA Solutions Engine

Engine Specifications		
Emission Units	BS GEN-1	
Engine	MESA Solutions	
Fuel Type	Natural Gas	
Engine Power[1]	684	hp
Heat Input[1]	4.7	MMBtu/hr/engine
Annual Hours of Operation	100	hr/yr/engine
Daily Hours of Operation	4	hr/day/engine
Total Number of Black Start Engines at the site[1]	1	engine

Notes:

1. Engine data provided by manufacturer.

Criteria Pollutant Emissions

Pollutant	Short-Term, Daily and Annual Emissions		
	lb/hr	lb/day	tpy
VOC	0.089	0.36	4.4E-03
NO_x	0.13	0.51	6.3E-03
CO	0.030	0.12	1.5E-03
$PM/PM_{10}/PM_{2.5}$	0.092	0.37	4.6E-03
SO_2	2.8E-03	0.011	1.4E-04

Criteria Pollutant Emission Factors

Pollutant	Controlled Emission Factor[1]	Emission Rate
	g/hp-hr	lb/hr
VOC (NMHC)	0.059	0.089
NO_x	0.084	0.13
CO	0.020	0.030

Notes:

1. The controlled emission factor is the maximum of vendor-provided controlled emission factors.

Pollutant	Emission Factor[1]	Emission Rate
	lb/MMBtu	lb/hr
$PM/PM_{10}/PM_{2.5}$[2]	1.9E-02	0.092
SO_2	5.9E-04	2.8E-03

Notes:

1. Emissions of PM and SO_2 are based on AP-42, Table 3.2-3 (Emission Factors for natural gas-fired four-stroke rich burn engines).
2. All PM emissions include the condensable PM emissions.

Table 6. Potential Emission Calculations - Criteria Pollutants and Greenhouse Gases from the MESA Solutions Engine

Greenhouse Gas (GHG) Emissions

Pollutant	Emissions for All Engines	
	lb/hr	tpy
CO_2	816	41
CH_4	1.3	0.063
N_2O	0.060	3.0E-03
CO_2e[1]	867	43

Notes:

1. The carbon dioxide equivalent (CO_2e) emission factor is calculated as the sum of each GHG pollutant multiplied by its global warming potential.
   Global warming potentials are based on 40 CFR 98, Subpart A, Table A-1:

CO_2:	1
CH_4:	28
N_2O:	265

Greenhouse Gas (GHG) Emission Factors

Pollutant	Controlled Emission Factor[1]	Emission Rate
	g/hp-hr	lb/hr
CO_2	541	816
CH_4	0.83	1.3
N_2O	0.040	0.060

Notes:

1. The controlled emission factor is the maximum of vendor-provided controlled emission factors.

Table 7. Potential Emission Calculations - Hazardous and Toxic Air Pollutants from the MESA Solutions Engine

Engine Specifications		
Emission Units	BS GEN-1	
Engine	MESA Solutions	
Fuel Type	Natural Gas	
Engine Power[1]	684	hp
Heat Input[1]	4.742	MMBtu/hr/engine
Annual Hours of Operation	100	hr/yr/engine
Daily Hours of Operation	4	hr/day/engine
Total Number of Black Start Engines at the site[1]	1	engine

Notes:

1. Engine data provided by manufacturer.

Table 7. Potential Emission Calculations - Hazardous and Toxic Air Pollutants from the MESA Solutions Engine

Toxic Air Pollutant Emissions

Pollutant	Maximum Emission Factor[1]	Emissions - All Engines		
		Hourly	Daily	Annual
	lb/MMBtu	lb/hr	lb/day	tpy
Primary NO_2[2]	2.7E-03	0.013	0.051	6.3E-04
CO	6.4E-03	0.030	0.12	1.5E-03
SO_2	5.9E-04	2.8E-03	0.011	1.4E-04
NH_3[3]	5.0 ppmv	0.03	0.12	1.5E-03
1,1,2,2-Tetrachloroethane	2.5E-05	1.2E-04	4.8E-04	6.0E-06
1,1,2-Trichloroethane	1.5E-05	7.3E-05	2.9E-04	3.6E-06
1,1-Dichloroethane	1.1E-05	5.4E-05	2.1E-04	2.7E-06
1,2-Dichloroethane	1.1E-05	5.4E-05	2.1E-04	2.7E-06
1,2-Dichloropropane	1.3E-05	6.2E-05	2.5E-04	3.1E-06
1,3-Butadiene	6.6E-04	3.1E-03	0.013	1.6E-04
1,3-Dichloropropene	1.3E-05	6.0E-05	2.4E-04	3.0E-06
Acetaldehyde	2.8E-03	0.013	0.053	6.6E-04
Acrolein	2.6E-03	0.012	0.050	6.2E-04
Benzene	1.6E-03	7.5E-03	0.030	3.7E-04
Butyr/Isobutyraldehyde	4.9E-05	2.3E-04	9.2E-04	1.2E-05
Carbon Tetrachloride	1.8E-05	8.4E-05	3.4E-04	4.2E-06
Chlorobenzene	1.3E-05	6.1E-05	2.4E-04	3.1E-06
Chloroform	1.4E-05	6.5E-05	2.6E-04	3.2E-06
Ethane	7.0E-02	0.33	1.3	0.017
Ethylbenzene	2.5E-05	1.2E-04	4.7E-04	5.9E-06
Ethylene Dibromide	2.1E-05	1.0E-04	4.0E-04	5.1E-06
Formaldehyde	2.1E-02	0.10	0.39	4.9E-03
Methanol	3.1E-03	0.015	0.058	7.3E-04
Methylene Chloride	4.1E-05	2.0E-04	7.8E-04	9.8E-06
Naphthalene	9.7E-05	4.6E-04	1.8E-03	2.3E-05
PAH	1.4E-04	6.7E-04	2.7E-03	3.3E-05
Styrene	1.2E-05	5.6E-05	2.3E-04	2.8E-06
Toluene	5.6E-04	2.6E-03	0.011	1.3E-04
Vinyl Chloride	7.2E-06	3.4E-05	1.4E-04	1.7E-06
Xylenes	2.0E-04	9.2E-04	3.7E-03	4.6E-05
TOTAL HAPS		**1.5E-01**	**6.2E-01**	**1.0E-02**

Notes:

1. Toxics/HAP emission factors are based on AP-42. Chapter 3.2-3.
2. NO_2 emissions are assumed 10% of NO_X emissions.
3. Ammonia slip data provided by the manufacturer. Peak ammonia emissions conservatively assume no startup events occur during the emission period.

   Ammonia emissions for each engine proposed at the facility are calculated as follows:

   Short term emissions (lb/hr/engine) = (NH3 Slip [ppmv] / 10^6) * (1 / Molar Vol. of Flue Gas [scf/lb-mol]) * MW of NH3 [lb/lb-mol] * Flue Gas Flow Rate [acfm] * 60 [min/hr]

   Annual emissions (tpy per engine) = Short term emissions (lb/hr/engine) * 8760 [hr/day] / 2000 [lb/ton]

   Short-term emissions (lb/hr - total) = Short-term emissions (lb/hr/engine) * (number of engines)

   Annual emissions (tpy - total) = Annual emissions (tpy per engine) * (number of engines)

Table 8. Potential Emission Calculations - Particulate Matter from On-site Unpaved Roads

Vehicle Information

Vehicle Type	Maximum number of vehicles	Maximum trips per day[1]	Maximum Weight of Loaded Vehicle[1]	Maximum one-way distance	Maximum one-way distance	Vehicle Miles Traveled (VMT)	Vehicle Weight x VMT	Maximum one-way miles
		trip/day	tons/trip	feet/trip	miles/trip	miles/day	ton-miles/trip-day	miles/year
CNG Truck (entering plant - EMPTY) (one-way trip)	1	20	30	1,600	0.30	6.1	182	2,212
CNG Truck (leaving plant - FULL) (one-way trip)	1	20	39	1,600	0.30	6.1	233	2,212
Pickup Truck (entering plant) (one-way trip)	1	8	4.3	1,600	0.30	2.4	10	885
Pickup Truck (leaving plant) (one-way trip)	1	8	4.3	1,600	0.30	2.4	10	885
	TOTALS	**56**				**17**	**436**	**6,194**

Notes:

1. Vehicle data is provided by VoltaGrid.

Particulate Matter Emission Factors

Variable	PM	PM_{10}	$PM_{2.5}$
Unmitigated Emission Factor, E[1]	6.8	1.7	0.17
Naturally Mitigated Emission Factor, E_{ext}[1]	5.1	1.3	0.13
Dust Control Efficiency[2]	84%	84%	84%

Notes:

1. The Naturally Mitigated Emission Factor is calculated with a combination of Equations 1a and 2 from AP-42 Section 13.2.2, whose formula is:
   $E_{ext} = E * [(365 - P)/365]$
   $E = k*[(s/12)^a]*[(W/3)^b]$

   where k is the particle size multiplier in lb/mile, s is the mean percent silt content of unpaved roads, a is a constant, W is average vehicle weight in tons, b is a constant, and P is the number of days of rain greater than or equal to 0.01 inches. E is the Unmitigated Emission Factor.
   For each size of particulate matter, these variables have the following values:

	PM	PM_{10}	$PM_{2.5}$	Source
k =	4.9	1.5	0.15	AP-42 Table 13.2.2-2 for Industrial Roads
s =	4.8	4.8	4.8	AP-42 Table 13.2.2-1 Plant Roads at Sand and Gravel Processing facilities
a =	0.7	0.9	0.9	AP-42 Table 13.2.2-2 for Industrial Roads
W =	26	26	26	VoltaGrid
b =	0.45	0.45	0.45	AP-42 Table 13.2.2-2 for Industrial Roads
P =	90	90	90	AP-42 Figure 13.2.2-1

2. VoltaGrid will be applying dust suppressant annually to the unpaved roads. This corresponds with a dust control efficiency of 84% according to Table 6-6 of the WRAP Fugitive Dust Handbook available at: https://www.env.nm.gov/wp-content/uploads/sites/2/2017/02/WRAP_FDHandbook_Rev_06.pdf

Particulate Matter Emissions

Process	Naturally Mitigated PTE of PM (Before Control)	Naturally Mitigated PTE of PM_{10} (Before Control)	Naturally Mitigated PTE of $PM_{2.5}$ (Before Control)	Mitigated PTE of PM (After Control)	Mitigated PTE of PM_{10} (After Control)[1]	Mitigated PTE of $PM_{2.5}$ (After Control)[1]	Mitigated PTE of PM (After Control)	Mitigated PTE of PM_{10} (After Control)	Mitigated PTE of $PM_{2.5}$ (After Control)
	tons/year	tons/year	tons/year	tons/year	tons/year	tons/year	lb/hr	lb/hr	lb/hr
CNG Truck (entering plant - EMPTY) (one-way trip)	5.7	1.4	0.14	0.90	0.23	0.023	0.21	0.053	5.3E-03
CNG Truck (leaving plant - FULL) (one-way trip)	5.7	1.4	0.14	0.90	0.23	0.023	0.21	0.053	5.3E-03
Pickup Truck (entering plant) (one-way trip)	2.3	0.58	0.058	0.36	0.092	9.2E-03	0.083	0.021	2.1E-03
Pickup Truck (leaving plant) (one-way trip)	2.3	0.58	0.058	0.36	0.092	9.2E-03	0.083	0.021	2.1E-03
TOTALS	**16**	**4.0**	**0.40**	**2.5**	**0.65**	**0.065**	**0.58**	**0.15**	**0.015**

Notes:

1. Per WAC 173-400-110(5), Table 110(5) contains exemption levels based on potential annual emissions. Per Table 110(5) Exemption levels, emissions of PM10 and PM2.5 are below the exemption levels and are exempt from permitting and modeling.

Table 9. Toxic Air Pollutant Screening Evaluation

Toxic Air Pollutant Emissions		Facility-Wide Emissions	De Minimis	SQER	Review Required
Pollutant	Avg. Period	lb/averaging period			
Primary NO_2	1-hr	1.0	0.46	0.87	Model
CO	1-hr	24	1.1	43	Report
SO_2	1-hr	1.42	0.46	1.2	Model
NH_3	24-hr	85	1.9	37	Model
1,1,2,2-Tetrachloroethane	year	13	0.14	2.8	Model
1,1,2-Trichloroethane	year	10	0.51	10	Model
1,1-Dichloroethane	year	7.5	5.1	100	Report
1,2,3-Trimethylbenzene	24-hr	0.021	0.22	4.4	No
1,2,4-Trimethylbenzene	24-hr	0.013	0.22	4.4	No
1,2-Dichloroethane	year	7.5	0.31	6.2	Model
1,2-Dichloropropane	year	8.6	0.81	16	Report
1,3,5-Trimethylbenzene	24-hr	0.030	0.22	4.4	No
1,3-Butadiene	year	114	0.27	5.4	Model
1,3-Dichloropropene	year	8.4	2	41	Report
Acetaldehyde	year	2,671	3	60	Model
Acrolein	24-hr	4.7	0.0013	0.026	Model
Benz(a)anthracene	year	0.018	0.045	0.89	No
Benzene	year	141	1	21	Model
Benzo(a)pyrene	year	8.4E-04	0.0082	0.16	No
Benzo(b)fluoranthene	year	0.053	0.045	0.89	Report
Benzo(k)fluoranthene	year	2.4E-03	0.045	0.89	No
Carbon Tetrachloride	year	12	1.4	27	Report
Chlorobenzene	24-hr	0.028	3.7	74	No
Chloroethane	24-hr	1.7E-03	110	2200	No
Chloroform	year	9.1	0.35	7.1	Model
Chrysene	year	0.22	0.45	8.9	No
Dibenz(a,h)anthracene	year	8.4E-04	0.0041	0.082	No
Ethylbenzene	year	22	3.2	65	Report
Ethylene Dibromide	year	14	0.014	0.27	Model
Formaldehyde	year	12,467	1.4	27	Model
Indeno(1,2,3-c,d)pyrene	year	2.2E-03	0.045	0.89	No
Methanol	24-hr	2.3	74	1500	No
Methylene Chloride	year	6.4	490	9800	No
n-Hexane	24-hr	1.0	2.6	52	No
Naphthalene	year	24	0.24	4.8	Model
Perchloroethylene	year	0.79	1.3	27	No
Phenol	24-hr	0.022	0.74	15	No
Propylene	24-hr	4.7	11	220	No
Styrene	24-hr	0.022	3.2	65	No
Toluene	24-hr	0.38	19	370	No
Vinyl Chloride	year	4.8	0.92	18	Report
Xylenes	24-hr	0.57	0.82	16	No

Table 10. VoltaGrid J620 Modeled Stack Parameters and Emission Rates

Stack Parameters

Parameter	100% Load Values		75% Load Values	
Stack Height[2]	10.36	m	10.36	m
Stack Diameter[2]	0.61	m	0.61	m
Temperature[1]	361.1	°C	417.2	°C
Exhaust Flow Rate (Standard Wet)[1]	8,638	scfm	6,428	scfm
Exhaust Flow Rate (Actual)	20,050	acfm	16,241	acfm
Exit Velocity	32.4	m/s	26.3	m/s

National Ambient Air Quality Standards (NAAQS) and Washington Ambient Air Quality Standards (WAAQS)

Pollutant	Averaging Time	Emission Rate of Each Generator[2,3]	
		lb/hr	g/s
CO	8 hours	1.7	2.2E-01
	1 hour	1.7	2.2E-01
NO_X	Annual	0.14	1.8E-02
	1 hour	0.71	9.0E-02
$PM_{2.5}$	Annual	0.10	1.3E-02
	24 hours	0.079	9.9E-03
PM_{10}	24 hours	0.079	9.9E-03
SO_2	Annual	0.10	1.3E-02
	3 hours	0.10	1.3E-02
	1 hour	0.10	1.3E-02

Toxic Air Pollutants (TAPs)

Pollutant	Averaging Period	Emission Rate of Each Generator	
		lb/hr	g/s
Primary NO_2	1-hr	0.71	0.090
SO_2	1-hr	0.10	0.013
NH_3	24-hr	0.25	0.032
1,1,2,2-Tetrachloroethane	year	1.0E-04	1.3E-05
1,1,2-Trichloroethane	year	8.3E-05	1.0E-05
1,2-Dichloroethane	year	6.1E-05	7.7E-06
1,3-Butadiene	year	9.3E-04	1.2E-04
Acetaldehyde	year	0.022	2.7E-03
Acrolein	24-hr	0.014	1.7E-03
Benzene	year	1.1E-03	1.4E-04
Chloroform	year	7.4E-05	9.4E-06
Ethylene Dibromide	year	1.2E-04	1.5E-05
Formaldehyde	year	0.10	1.3E-02
Naphthalene	year	1.9E-04	2.4E-05

Notes:

1. Data for worst-case load operations (100% and 75%) from the mobile Jenbacher specification sheet (Appendix D).
2. Provided by VoltaGrid.
3. For 1-hour, 3-hour, and 8-hour standards, it is conservatively assumed that there will be one startup in every hour. For 24-hour standards, it is assumed there will be one startup per day. For annual standards, it is assumed there will be three startups per month. Each startup period is assumed to be no longer than 5 minutes. Emissions are based on the rate for the worst-case load identified in the load screening analysis (100%).

Table 11. VoltaGrid Black Start Modeled Stack Parameters and Emission Rates

Stack Parameters

Parameter	Value	
Number of Stacks[1]	2	
Stack Height[1]	3.18	m
Stack Diameter[1]	0.10	m
Temperature[2]	510.0	°C
Exhaust Flow Rate Per Stack (Standard)[1,3]	438	scfm
Exhaust Flow Rate Per Stack (Actual)[3]	1,169	acfm
Exit Velocity Per Stack	68.0	m/s

National Ambient Air Quality Standards (NAAQS) and Washington Ambient Air Quality Standards (WAAQS)

Pollutant	Averaging Time	Emission Rate of Each Stack	
		lb/hr	g/s
CO	8 hours	0.015	1.90E-03
	1 hour	0.015	1.90E-03
NO_X	Annual	7.2E-04	9.11E-05
	1 hour	0.063	7.98E-03
$PM_{2.5}$	Annual	5.3E-04	6.62E-05
	24 hours	7.7E-03	9.66E-04
PM_{10}	24 hours	7.7E-03	9.66E-04
SO_2	Annual	1.6E-05	2.01E-06
	3 hours	1.4E-03	1.76E-04
	1 hour	1.4E-03	1.76E-04

Toxic Air Pollutants (TAPs)

Pollutant	Averaging Period	Emission Rate of Each Stack	
		lb/hr	g/s
Primary NO_2	1-hr	0.063	7.98E-03
SO_2	1-hr	1.4E-03	1.76E-04
NH_3	24-hr	2.6E-03	3.25E-04
1,1,2,2-Tetrachloroethane	year	6.8E-07	8.63E-08
1,1,2-Trichloroethane	year	4.1E-07	5.22E-08
1,2-Dichloroethane	year	3.1E-07	3.85E-08
1,3-Butadiene	year	1.8E-05	2.26E-06
Acetaldehyde	year	7.6E-05	9.51E-06
Acrolein	24-hr	1.0E-03	1.31E-04
Benzene	year	4.3E-05	5.39E-06
Chloroform	year	3.7E-07	4.67E-08
Ethylene Dibromide	year	5.8E-07	7.26E-08
Formaldehyde	year	5.5E-04	6.99E-05
Naphthalene	year	2.6E-06	3.31E-07

Notes:

1. Data for 100% load operations from the specification sheet for the Mesa GV22PU engine. The Mesa Black Start engine contains a dual exhaust system. The exhaust flow and velocity parameters are assumed to divide evenly into each exhaust stack.
2. Provided by VoltaGrid.
3. The standard exhaust flow rate was converted from lb/hr to scfm using 28.79 lb/lb-mole of the exhaust gas and 385.33 scf/lb-mole at 68 degrees Fahrenheit .The actual exhaust flow rate per stack was converted from the standard exhaust flow rate using standard temperature and pressure of 68 degrees Fahrenheit and 1 atm and actual temperature and pressure of 510 degrees Celsius and 1 atm.

Table 12. J620 Worst-case Load Screening Analysis Results

Load	Dispersion Factor			Load Sceening Concentrations[1]					
	1-hour	24-hour	Annual	NO_2 1-hour	NO_2 Annual	CO 1-hour	$PM_{2.5}/PM_{10}$ 24-hour	$PM_{2.5}$ Annual	SO_2 and TAPs 1-hour
	$\mu g/m^3$ per lb/hr			$\mu g/m^3$					
50%	12	3.1	0.12	25.9	0.43	71	0.168	0.0068	0.66
75%	9.0	2.2	0.10	30	0.50	72	0.18	0.0078	0.71
100%	7.0	1.6	0.088	30	0.51	94	0.17	0.0089	0.71

Notes:

1. Tier 3 PVMRM was used for the NOx-to NO2 chemical transformation model using an in-stack ratio of 0.1, equilibrium ratio of 0.9, and ozone concentration of 51.8 ppb. All other pollutants were calculated from the dispersion factor and manufacturer provided emission rates.
2. Highlighted cells indicate which operating load correlates to the highest modeled impact for each pollutant and averaging period.

Table 13. Predicted Project Concentrations Compared to Significant Impact Level and the National Ambient Air Quality Standards

Significant Impact Level Analysis Results

Pollutant	Averaging Period	AERMOD File Name	Modeled Concentration[1] µg/m³	SIL[2] µg/m³	Over SIL?
NO_2[3,4]	1-Hour	vg.quincy.no2.1hr.inp	28	7.5	YES
	Annual	vg.quincy.no2.ann.inp	0.18	1	NO
CO	1-Hour	vg.quincy.co.inp	110	2,000	NO
	8-Hour	vg.quincy.co.inp	61	500	NO
PM_{10}[4]	24-Hour	vg.quincy.pm.24hr.inp	2.0	5	NO
$PM_{2.5}$[4]	24-Hour	vg.quincy.pm.24hr.inp	2.0	1.2	YES
	Annual	vg.quincy.pm.annual.inp	0.14	0.13	YES
SO_2[3,4]	1-Hour	vg.quincy.so2.1hr.inp	4.4	7.8	NO
	3-Hour	vg.quincy.so2.3hr.inp	5.2	25	NO

Notes:

1. Modeled concentrations are the maximum concentration predicted by the model for the applicable averaging period and were modeled at the worst-case load ≥50%. For the black start engines, the worst-case load is 100% for all pollutants and averaging periods. For the J620s, the worst-case load is 100% load for all pollutants and averaging periods except for 24-hour $PM_{2.5}$ and 24-hour PM_{10} which has a worst-case emission at 75% load.
2. SIL = significant impact level, from WAC 173-400-113, except 1-hour average NO_2 and SO_2, which are interim standards provided by EPA guidance memoranda (Page, 2010a; Page, 2010b) and the new EPA-recommended annual $PM_{2.5}$ SIL of 0.13 µg/m³.
3. The model predicted concentration for the 1-hour average of NO_2 and SO_2 is represented by the 5-year average of the highest first highs per EPA guidance (Page, 2010a; Page, 2010b).
4. The annual NO_2, 24-hour $PM_{2.5}$, 24-hour PM_{10}, and 3-hour SO_2 SIL results are the maximum impacts over all 5 years.

References

Guidance Concerning the Implementation of the 1-hour NO2 NAAQS for the Prevention of Significant Deterioration Program, Stephen D. Page, Director of the Office of Air Quality Planning and Standards, June 29, 2010(a).

Guidance Concerning the Implementation of the 1-hour SO2 NAAQS for the Prevention of Significant Deterioration Program, Stephen D. Page, Director of the Office of Air Quality Planning and Standards, Aug 23, 2010(b).

Criteria Pollutant NAAQS Results

Pollutant	Averaging Period	AERMOD File Name	Modeled Concentration[1] µg/m³	Background Concentration[2] µg/m³	Total Concentration µg/m³	NAAQS µg/m³	Over NAAQS?
NO_2	1-hour	vg.quincy.no2.1hr.out	18	42	60	188	NO
$PM_{2.5}$	24-hour	vg.quincy.pm.24hr.out	0.70	18	19	35	NO
$PM_{2.5}$	Annual	vg.quincy.pm.annual.out	0.12	4.9	5.0	9.0	NO

Notes:

1. For the NAAQS analysis, the 1-hour NO_2 and 24-hour $PM_{2.5}$ design concentrations are the five-year average of the 98th percentile of the respective daily maximum 1-hour averaged and 24-hour averaged concentrations. The annual $PM_{2.5}$ design concentration is the five-year average of the annual mean concentrations.
2. The background concentration for NO_2 is from Ecology's August 2020 Storymap. The background concentration for $PM_{2.5}$ is the 2024 design value from the Quincy monitor. The background concentration for 24-hour $PM_{2.5}$ and annual $PM_{2.5}$ are from the Quincy monitor operating from 2022 to 2024.

Table 14. Predicted Project Concentrations Compared to Acceptable Source Impact Levels

Toxic Air Pollutants under WAC 173-460-150

Pollutant	CAS No.	Averaging Period	AERMOD File Name	Facility-wide Emission Rate	Project Concentration	ASIL[1]	Over ASIL?
				lbs/avg. period	µg/m^3	µg/m^3	
Primary NO_2	10102-44-0	1-hr	vg.quincy.no2.1hr.inp	1.0	42	470	NO
SO_2	7446-09-5	1-hr	vg.quincy.so2.1hr.inp	1.4	6.6	660	NO
NH_3	7664-41-7	24-hr	vg.quincy.ammonia.inp	85	4.9	500	NO
1,1,2,2-Tetrachloroethane	79-34-5	year	vg.quincy.1122tetrachloroethane.inp	13	0.00014	0.017	NO
1,1,2-Trichloroethane	79-00-5	year	vg.quincy.112trichloroethane.inp	10	0.00011	0.063	NO
1,2-Dichloroethane	107-06-2	year	vg.quincy.12dichloroethane.inp	7.5	0.000084	0.038	NO
1,3-Butadiene	106-99-0	year	vg.quincy.13butadiene.inp	114	0.0013	0.033	NO
Acetaldehyde	75-07-0	year	vg.quincy.acetaldehyde.inp	2,671	0.030	0.37	NO
Acrolein	107-02-8	24-hr	vg.quincy.acrolein.inp	4.7	0.28	0.35	NO
Benzene	71-43-2	year	vg.quincy.benzene.inp	141	0.0017	0.13	NO
Chloroform	67-66-3	year	vg.quincy.chloroform.inp	9.1	0.00010	0.043	NO
Ethylene Dibromide	106-93-4	year	vg.quincy.ethylenedibromide.inp	14	0.00016	0.0017	NO
Formaldehyde	50-00-0	year	vg.quincy.hcho.inp	12,467	0.14	0.17	NO
Naphthalene	91-20-3	year	vg.quincy.naphthalene.inp	24	0.00027	0.029	NO

Notes:

1. ASIL = Acceptable Source Impact Level, from WAC 173-460-150.

APPENDIX D
EQUIPMENT SPECIFICATIONS AND PERFORMANCE DATA

James Bowdoin
Voltagrid
10800 Telge Rd
Houston, TX 77095
Mobile: 1(254)334-0424

y/ref Washington Site | o/ref 209257 | 28 October 2025

your inquiry:	**Voltagrid J620 x14 Washington Site**
our offer:	**209257 Rev1**
our product:	**combiKat™: SCR and/or OXI Treatment**

Dear Mr. Bowdoin

Thank you for the chance to quote our SCR system solution for the Washington site. Based on the given emissions requirements for these units, please find our offer for our CombiKat® SCR system with a layer of ROM as well as a Pre-Oxi box added to support the site requirement. The 2 box system is required for this project due to the stringent emissions requirements for the site. We have also included an upgraded control system that allows better interface and dosing control.

Please review the updated project scope and regulation parameters to confirm it is what was discussed and agreed. This quote includes the scope of the product itself and does not include final location shipping, commissioning or any service agreements.

If you need any additional information or if you would like to go into a more detailed discussions, please consider us available.

We are looking forward to getting your initial feedback.

Best Regards,

Eric Schepman

Eric Schepman
Project Manager and Sales Lead
HUG Engineering Inc
E: Eric.Schepman@hug-engineering.com

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1. Introduction

1.1. General

The development, production, engineering and sale of emission control systems is the core business of Hug Engineering Inc. For more than 30 years, we realize standard solutions as well as customized solutions for diesel and gas engines in stationary and mobile applications.

1.2. Important project notes

1.2.1 Exhaust gas temperature

The engine exhaust temperature at full load was indicated in your inquiry and is reported in this offer under section 2.3, however as gas engines usually have their highest exhaust gas temperature at a lower load it is recommended to check the actual operating load and relevant exhaust temperature profile before placing an order for any catalytic after treatment system.

The maximum allowed exhaust gas temperature for the catalysts is specified section 8.1.5.2
The minimum system temperature to avoid deposits in the system is 520°F.

1.2.2 Arrangement of catalyst, heat exchanger and further equipment along the exhaust piping.

The catalytic system must be the first piece of equipment along the exhaust line, so immediately downstream the engine outlet. Any other equipment such as economizers, scrubbers, mufflers or similar must be installed downstream the catalytic system.

1.2.3 Thermal expansion

The housing of the catalyst and the connected exhaust tubes must be placed and fixed with enough free movement to allow for thermal expansion. During the project execution phase Hug Engineering will provide engineering instructions for the proper installation of its equipment.

1.2.4 Temperature tolerance

Please refer to product specification sheets for standard temperature tolerances. Unless otherwise specified, measures to winterize and/or cooler systems are not included. These can be added with price addition. If ammonia water is being used, all component dealing with ammonia water must be protected from direct sunlight to avoid gasification of the liquid. Minimum temperature for these components is 0°C

1.3. Chronology

10/17/2025: Initial quote
10/28/2025: Added Formaldehyde to the guarantee.

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2. Project - data

2.1. Project specific

The offer is based on engine technical data and reduction requirements per customer's provision.

2.2. Source of exhaust gas

Engine	J620
Quantity	14 Units
Power Output @ 100% load	4601 bhp
Fuel	Natural Gas
Pollutants in Fuel	In acc. to C.00374

2.3. Raw gas emissions

2.3.1 The design and performance guarantee of this offer relies on the following exhaust gas data.

	@ 100% load (J620)
Exhaust gas temperature	850 °F
Mass flow rate	38, 946 lb/hr (wet)
NOx Nitrogen oxides(as NO2)	<0.69 g/hp-hr
CO	<1.30 g/hp-hr
VOC (NMNEHC)	<0.01 g/hp-hr
Formaldehyde (CH_20)	<0.20 g/hp-hr

2.4. Performance guarantee

2.4.1 Guarantee period

System running time	16,000 operating hours
or max. 24 months after the day the exhaust gas has passed through the catalyst for the first time (whichever occurs sooner) and/or max. 36 months after the delivery EXW of the equipment. The performance guaranty strictly follows our poison list C.00374.	

2.4.2 Catalytic performance during guaranteed period

CombiKat® skidded SCR systems Pollutants measured downstream the catalytic system:

NOx Nitrogen oxides (as NO_2)	< 0.0138 g/hp-hr
CO	< 0.0653 g/hp-hr
VOC (NMNEHC excluding CH_2O)	< 0.0067 g/hp-hr
Formaldehyde (CH_20)	< 0.0100 g/hp-hr

- based on 60min steady state avg testing
- VOC defined as NMNEHC with the general formular C_xH_y
- If VOC emissions guarantees are given mass based (e.g. g/bhp-hr), the VOC emissions are calculated as C_3H_8, mass on dry exhaust mass flow in accordance with US EPA Regulation 40 CFR 60.4244/ 40 CFR Part 60 Subpart JJJJ
- If VOC emissions guarantees are given volume based (e.g. Vol.%, ppm), the VOC emissions are counted as C_3H_8
- Only VOC measurements based on USEPA Method 18 of 40 CFR part 60, appendix A (Gas Chromatography) or equivalent GC-Method will be accepted.
- The following assumptions are valid unless more detailed information regarding the engine out VOC composition is provided in writing and acknowledged by Hug.
- Only valid if propane (C_3H_8) is less than 0.00603 g/hp-hr in the exhaust gas engine out
- Only valid if the sum of saturated hydrocarbons of group C3 and greater (such as propane, butane, pentane, hexane ...) is less than 0.00804 g/hp-hr in the raw exhaust gas engine out

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2.5. Design parameter

2.5.1 Designed pressure drop

ΔP @ full load	measured across the catalytic system at commissioning silencer and mesh filter not included (at new and clean condition)	≤ 27 mbar

3. Price, Terms and Conditions

3.1. Pricing

3.2. Terms of payment

• 30% initial payment with order of 14 units • 65% as units are delivered • 5% after commissioning, latest 12 months after delivery. Note: 1.1% Monthly interest payment for overdue amount 1st day month	Net 30 days

3.3. Price validity

30 days from the issuing date of this offer.

3.4. Incoterms

Completed Skid Inco terms FCA from Columbus, IN (Shipping to Washington not included) according to Incoterms 2020

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3.5. Packing

Seaworthy packing where necessary	
Completed skid:	1 / truck
Catalysts:	wooden boxes ISPM15 **(Must be stored indoor)**
Control-unit:	wooden boxes ISPM15 **(Must be stored indoor)**
Mixing-elements	on wooden pallet

3.6. Delivery time and terms

Completed Skid Inco terms FCA from Columbus, IN (Shipping to Washington not included)

Timing will be discussed and confirmed at time of PO. Estimated lead time is 22 weeks for first part delivery.

3.7. Customer's scope (to be provided by customer)

- Lifting device with sufficient lifting capacity (for weights please consult the data sheets)
- Electrical connection 480 VAC
- Electrical connection 120 VAC / 60 Hz
- Digital signal "Exhaust Mass Flow signal"
- Analogue signal "Engine load", 4-20 mA
- Consumables for the start-up and commissioning as reactant, fuel/gas for the engine, el. Power
- Manpower and infrastructures for setting systems

3.8. Exclusions of the scope of Hug Engineering Inc as offered

- Expansion joints and vibration dampers incl. supports, anchors, etc. (unless otherwise specified by Hug)
- Fittings, materials for construction and bulk materials in general
- Reactant pipes (heated if below +5°C)
- Winterization measures unless otherwise specified
- Urea Solution tank system and all auxiliaries (unless otherwise specified by Hug)
- Erection and installation works (involving catalyst loading if needed).
- Infrastructure adaptations
- Other assembling and set-up consumables that are not listed above
- Maintenance, spares and replacements
- Engineering and activities for class, flag or statutory certifications (if needed)

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4. Exhaust Purification System

4.1. CombiKat™ exhaust gas purification system

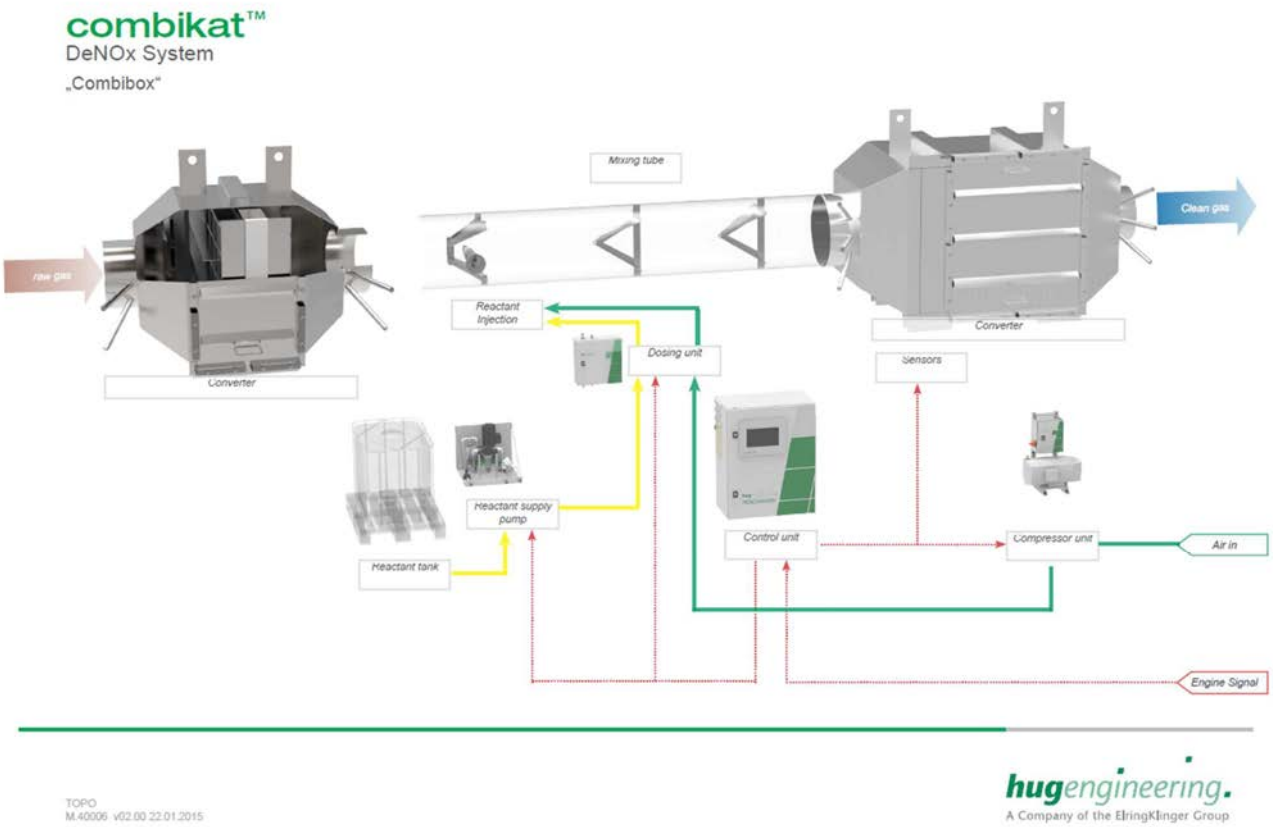
CombiKat™ is an integrated system for the catalytic abatement of polluting emissions released by endothermic engines running on every type of gaseous and liquid fuels.

Following the concept of modular design of the catalytic elements and the proper urea dosing technology, available both in open loop and as feed-back loop controlled by the measured emissions after the catalyst, CombiKat is capable to reduce emissions down to level compliant with the strictest regulations worldwide.

CombiKat applications are reliably running at single digit concentrations of NOx, NH3 and CO as for instance in the demanding field of CO2 fertilization of greenhouses using the trade name of CodiNOx ™.

Every CombiKat element is designed and manufactured in order to secure simple installation, trouble-free operation and minimal maintenance, consequently each single component is pre-assembled, cabled and tested in house during the pre-commissioning phase set as standard procedure in Hug's quality policy.

The following scheme effectively portrays the simplicity and linearity of the CombiKat architecture.



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4.2. Project Component List CombiKat™ SCR Solution

Equipment	Type	Components
SCR/ROM Reactor Housing	EMS120.90 304L	X
SCR Catalysts	RFV	240 each
ROM Catalysts	ROM	120 each
Pre-Oxi Housing	EMS80.30 304L	X
OXI Catalysts	OCT	160 each
Urea Injection Piping	ES800 – 32” dia.	X
- Injection port	E265	X
- Perf plate	800	X
- Dosing Mixer	DM800	X
- Mixer	800	2 each
- Bypass Probe	NP400	X
Controller (Closed Loop)	w/HMI Touch panel 12”	X
- Sample Gas Lines	.02mg1	2 each
- Air condition unit	.02acu	X
Dosing Box SEV	SEV	X
Reactant Injector	DEN20	X
Air Compressor	CA20	X
Sampling Probe	LS400.02	X
Temperature Sensor	TEA330	2 each
Over Temperature Switch	.lab (outdoor)	X
Pressure Sensor	PEA100.03	2 each
Insulated Day Tank	200 gallon	X
Hug Connect	SIM-card	X
Skid Package	Bolt-on	X
HMI Com box		X
SCR Reactor Insulation		X
Packing for shipment		Included
Technical documentation	As electronic file	Included

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4.3.Converter CombiKat® EMS120.90 (SCR)

Inlet	*axial, Ø800x4mm*
Outlet	*axial, Ø800x4mm*
Access	*from side*
Material	*304L*
Insulation	*Yes*
Flange	*Standard*
Connections	*4 measuring ports ½" at in- and outlet pipes, one measuring port per service access door*
Pressure	*max 200 mbar*

Configuration:

Layer	*1*	*SCR*	*300*	*mm*
Layer	*2*	*SCR*	*300*	*mm*
Layer	*3*	*SCR*	*150*	*mm*

Note: converter to be delivered empty – catalyst will be installed during commissioning

Welding universal tolerance EN ISO 13920-BF
Weld quality EN ISO 5817-C
General tolerances ISO 2768-mK

SCR

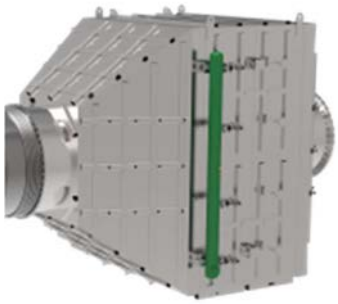

image may vary from final product

Project-remark:
Assembly contains all, gaskets, supports sheets for the entire catalyst installation.

4.4. Converter CombiKat® EMS80.30 (Pre-Oxi)

Inlet	*axial, Ø800x4mm*
Outlet	*axial, Ø800x4mm*
Access	*from side*
Material	*304L*
Insulation	*Yes*
Flange	*Standard*
Connections	*4 measuring ports ½" at in- and outlet pipes, one measuring port per service access door*
Pressure	*max 200 mbar*

Configuration:

Layer	*1*	*OCT*	*100*	*mm*
Layer	*2*	*OCT*	*100*	*mm*

Note: converter to be delivered empty – catalyst will be installed during commissioning

Welding universal tolerance EN ISO 13920-BF
Weld quality EN ISO 5817-C
General tolerances ISO 2768-mK

Pre OXI - EMS 80.30

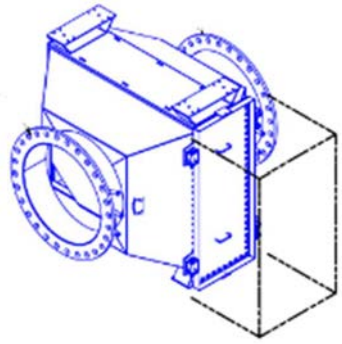

image may vary from final product

Project-remark:
Assembly contains all, gaskets, supports sheets for the entire catalyst installation.

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4.5.CombiKat™ mixing pipe

Straight mixing pipe for Urea injection, hydrolysis and mixing. *Hug Engineering's scope of supply includes the mixer's internal elements such as injection port, dosing mixer and static mixers. Piping and construction work not included.* *Certain dimensions on the drawing are the minimal required, longer lengths are acceptable. Piping between the dosing mixer and static mixer must be straight, downstream the first static mixer piping can be curved if needed.*					
1x	**Dosing – Mixer DM**				
	Material	*DIN 1.4301*			
	Diameter	*Ø*	*800*	*mm*	
	Max-temp		*550*	*°C*	
	Weight		*5*	*kg*	
1x	**Mixer M**				
	Material	*DIN 1.4301*			
	Diameter	*Ø*	*800*	*mm*	
	Max-temp		*550*	*°C*	
	Weight		*5*	*kg*	
1x	**Injector port – E**				
	Material	*DIN 1.4301*			
	Length		*265*	*mm*	
	Max-temp		*550*	*°C*	
	Weight		*3*	*kg*	
Project-remark: *in case of a bend upstream of the mixing-sections baffle-plates to be to be installed inside the bend (according to HUG-guidance)*					

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4.6.CombiKat™ control system (Jenbacher J620)

Reactant dosing unit MAP SNQ
Control system closed loop

Pre-commissioned control cubicle including all governing functions for:
- *urea dosing*
- *temperature and pressure drop monitoring*
- *bi-phase injector and driver*
- *compressed air system*
- *Automation safety chain management*

Material	*Steel 1.0037 powder coated RAL 7035, structured*
Weight	*60 kg*
Dimensions WxHxD	*600x760x250mm*
Power supply	*120V 50/60Hz*
Protection	*IP54*
Conformity	*CE-conformity*

Options:			
	Cable-labelling	*.lab*	*included*
	HMI touch-panel	*.ops*	*included*
	Gateway	*.gat*	*included*
	Modem for remote access	*.mod*	*not included*
	UL-conformity	*.UL*	*included*
	door-switch (CIP-Standard)	*.cdm*	*not included*
	key-look (CIP-Standard)	*.key*	*not included*
	Air conditioning unit	*.acu*	*included*
	Sampling Gas Line	*.mg1*	*included*

For further details note datasheet C.02253

image may vary from final product

1x

SCR dosing unit SEV

Cabinet including Urea flowmeter, dosing valve, intercepting and instrumentation equipment for automation safety chain, local gauges.

Dimensions *500x500x157mm*

For further details note datasheet C. *02150*

image may vary from final product

1x

Reactant injection unit DEN20.600.02
Reactant injector ≤ 20l/h reactant

Material	*Stainless steel 1.4307, 1.4435 or similar*
Max-flow	*20 l/h*
Temperature	*exhaust: ≤ +550°C* *media:-10…+55°C*

For further details note datasheet C.01016

image may vary from final product

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4.7. Skid Schematic

Bolt-On Skid Including: - Hardware & Gaskets for Exhaust System from Inlet to Stack - Header Pipe - 18" Testing Stack w/ Rain Cap - Carbon Steel Skid/Support Stand - Assembly of System on Skid - Install Dosing Components on Skid Including: o Mounting Main Panel, Dosing Box, Air Compressor o All Required Wiring for Temperature Sensor, Pressure Sensor, Air Compressor, Dosing Box, Power Supplies from Junction Box, Engine Run & Load Signal from Junction Box o Run Stainless/Poly Lines for Pressure Sensor o Run PTFE Air Line from Air Compressor to Dosing Box, Dosing Box to Injector o Run Stainless Line from Reactor Housing to Main Panel for Gas Sampling - Reactant pumps and pump controller to be installed and wired by customer at the site (bulk tank strategy)	*image may vary from final product* *Note: The sketch is of S32 unit, a Pre-Oxi reactor is added for these 72 units*

4.8. Scope of supply per site (can be shared if more than 1 engine is present at one site)

CombiKat™ Visualisation and communication

1x	**Touch screen HMI** Operating panel to supervise and interact with the controllers SNV by setting the operating parameters of the SCR systems and pumping station. Visualization of all activities of the SCR system including: • Process variables (temperatures, pressure drop, flowrates, etc.) • Status of the equipment (pumps, valves, etc.) • Safety chain signals • Diagnostic indications • Alarms and alarms records • Trends and logbook
1x	**Gateway (mounted into Main SCR-System – SNQ No1) – IN Com Box** For communication integration into customer-network per MOD-TCP Includes Hardware only - Software modification will be charged at actual costs according to section 7.2.1

Documentation

Manual for erection, installation, commissioning and maintenance - in English language - as file	3 set
Interconnection diagrams (PFDs, P&Is, electric schemes, etc.) and datasheets - as file	3 set
Installation drawings (converter with weights, main equipment) - as file	3 set
Commissioning report - as file	3 set

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5. Consumptions

5.1. Reactant consumptions

Urea 32.5 %, SOR at operating conditions acc. to 2.3

	J620
Expected Cons. @ 100% load	9.1 $^{l}/_{h}$
Max. Cons. @ 100% load	10.0 $^{l}/_{h}$

Urea consumption might vary in case of different process conditions from those reported above.

5.2. Compressed air consumption for injecting

Number of injectors per system	1
Compressed air consumption per system (Continuously while engine is running)	8 $^{Nm3}/_{h}$ / system is operated around 1bar, g
Max. consumption if the injection system is off. (During 15 min after the shutdown of engine)	10 $^{Nm3}/_{h}$

6. On-site-jobs

6.1. All Labor for commissioning - TBD

6.2. Conditions for the commissioning

6.2.1 General

Engine ready Proper installation Stable exhaust gas data according to section 2.3 Variation of the engine load below 1 % Reactant according to section 5.1

7. Warranties

7.1. Performance warranty for combiKat™ exhaust gas purification system

7.1.1 General

Hug Engineering AG is responsible for the offered combiKat™ exhaust gas purification systems, which are designed to operate on the exhaust gases originated by engines as listed under section 2.2 and exhaust raw gas compositions as listed under section 2.3 to comply with the present required exhaust gas limits as listed under section 2.4.The specified data are net of the measurement device tolerance and averaged over 60 minutes sampling and measuring time in stable conditions. Future requirements are not considered and shall be subject of re-design of the system.
Inlet gas C3+ hydrocarbons must be equal to or less then the below values given.

Daily Gas Quality Values

Chromatographs

Gas Day	Rel Density	HHV	N2	CO2	Methane	Ethane	Propane	Ibutane	Nbutane	Ipentane	Npentane	Hexanes
08/12/2024 08:00	0.614	1098.0	0.218	0.212	90.704	6.8	1.579	0.182	0.216	0.041	0.031	0.017

7.1.2 Design conditions

The design of the combiKat™ exhaust gas purification systems is based upon the raw gas data (see section 2.3) submitted to Hug Engineering AG. This latter is not liable for the exactness of such raw gas data.

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7.1.3 Warranty conditions

Hug Engineering AG warrants for the exhaust gas purification system provided that the Power Plant/Engine is operated in accordance with the operating manuals of the engine and power plant. Hug Engineering AG warrants for the exhaust gas purification systems which are serviced regularly according to the installation and operating manual. According to the manual certain maintenance activities shall only be carried out by an engineer from Hug Engineering AG or an authorized representative.

7.1.4 Validity of Performance guarantee

For the validity of the performance guarantee see section 2.3.1
Duration of the catalytic performance guarantee is based on a pro-rata temporis guarantee applicable on the fresh catalyst charge or partial re-integration.
If any of the goods are found be defective or otherwise not in conformity with the warranties HUG, as its sole option, shall replace and/or to repair and/or to integrate the defective part, and shall constitute the sole and only remedy under the warranty obligations.
Any guarantee is subject to the compliance with the supplier´s operation and maintenance manuals, included but not limited to maintenance plans, technical bulletins and any written and verbal instruction. Notwithstanding the forgoing, mechanical and chemical cleaning of the catalyst should not be considered an obligation of the seller neither should the necessity of any cleaning be considered as a breach of supplier´s warranties obligations. In case of early catalyst addition or replacement, it may be required for the customer to pay, on a "pro-rata temporis" basis, a portion of the replacement catalyst cost if an addition to the guarantee, based on the new catalyst, is realized.

7.1.5 Exclusions of the performance warranty

Hug Engineering AG declines any warranty should the catalysts be destroyed or inactivated due to accidental malfunctioning of the engine causing exceeding beyond the limit value(s) given herein. Furthermore, Hug Engineering AG refuses any warranty should the catalysts be destroyed or inactivated as a result of overheating, depositions of unburned fuel or lube-oil, sticky ash/dust as well as chemical destruction by catalyst poisons heavy metals and compounds.

7.1.5.1 Catalyst poisons

The catalyst system is designed for running the engine on the fuel type which is indicated in section 2.2. The system is not approved for running on animal-based oils/fats and/or waste oils and/or any mixes of these.
An overall quantification for each element is not possible because the poisonousness of these elements depends also on their combination and of the exhaust gas conditions. For the SCR- and for the OXI-catalysts certain chemical elements (and their compounds) are poisonous and their concentration in the process fluids such as fuel, urea and lube oil shall be limited as indicated in the specification C.00374 here attached.

7.1.5.2 Temperature range

combiKat™ SCR catalyst max. continuous operation:
C5 Catalyst: 645 °F - peak temperature: 850 °F

Exhaust temperatures between the max. continuous operation temperature and the peak temperature are allowed for max. 5% of the operating time. Exhaust temperatures above the peak temperature shall be limited to less than 1% of the operating time and nevertheless such event might unpredictably lead to precocious degradation of the catalyst for which Hug Engineering AG shall not to be considered liable

combiKat™ OXI catalyst max. continuous operation: 850 °F peak temperature: 930 °F

7.1.5.3 Proceeding in case of activity reduction at an early stage

In case that the activity of the combiKat™ catalysts is reduced by external influence an analysis of the catalysts and the fuel will be necessary. This analysis must be ordered by Hug Engineering AG. Labor for analysis is not included in this quotation. In case of early catalyst addition or replacement, it may be required for the customer to pay, on a "pro-rata temporis" basis, a portion of the replacement catalyst cost if an addition to the guarantee, based on the new catalyst, is realized.

7.2. Mechanical warranty for combiKat™ exhaust gas purification system

7.2.1 General

Hug Engineering AG warrants the mechanical integrity of the combiKat™ exhaust gas purification systems.

7.2.2 Conditions for the mechanical warranty

Hug Engineering AG ensures the warranty for exhaust gas purification systems which are serviced regularly according to the installation and operating manual. Maintenance must be carried out by an engineer from Hug Engineering AG or an authorized representative.

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7.2.3 Scope of the mechanical warranty

The mechanical warranty covers costs for the replacement or reparation of durable mechanical parts which have prematurely failed demonstrably due to construction or manufacturing defects attributable solely to Hug Engineering AG or one of its suppliers.

7.2.4 Exclusions of the mechanical warranty

Excluded from mechanical warranty are wear and tear of consumable parts such as filter-elements, sealings, compressor vanes, electrochemical sensors for the exhaust gas analyser, etc.
Excluded are also damages caused by improper use by the consignee or the plant operator.
Damages occurred during the transport between the dispatcher and the consignee are to be covered by a transport insurance. In this case only the value of the goods will be indemnified.

7.3. Validity of the guarantees

7.3.1 Performance guarantee

Performance guarantee is subject to the proper performance of a full maintenance schedule of engine and equipment by the final client, including recommended periodic maintenance on the instrumentation and control equipment and the recommended testing/cleaning of the catalyst.
For the validity of the performance guarantee see section 2.3.1

7.3.2 Mechanical warranty

2 years after commissioning, max. 28 months after the delivery of the equipment.

7.3.3 Site of guarantee

Site of warranty is Elsau (Switzerland).

7.4. General conditions of contract

General conditions of contract for the supply of plant and machinery

1. General

1.1 The contract shall be deemed to have been entered into upon receipt of supplier's order confirmation stating its acceptance of the order. Offers which are not confirmed by an order confirmation shall not be binding.
1.2 These general conditions of supply shall be binding as declared applicable in the offer and/or in the order confirmation . Any conditions stipulated by the customer which are in contradiction to these general conditions of supply shall only be valid if expressly acknowledged by the supplier in writing.
1.3 All agreements and legally relevant declarations of the parties to the contract must be agreed in writing in order to be valid. Declarations in text form which are transmitted by or recorded on electronic media will be equated with written declarations when specifically so agreed by the parties.
1.4 Should a provision of these general conditions of supply prove to be wholly or partly invalid, the parties to the contract shall jointly seek an arrangement having a legal and economic effect which will be as similar as possible to the invalid provision. Notwithstanding the above all other remaining provisions of the present general conditions of supply shall be valid and enforceable.

2. Scope of supplies and services

The supplies and services are exhaustively specified in the technical-commercial offer, order confirmation and in attached documentation thereto. The supplier shall be entitled to make any changes which lead to improvements provided such changes are agreed between the parties.

3. Technical documents

3.1 Data provided for in technical documentation are only binding in so far as having been expressly stipulated as such.
3.2 Each party to the contract retains all rights to technical documents provided to the other. The party receiving such documents recognises their confidentiality and the property rights, consequently it shall not –without previous written consent of the other party – make these documents available to any third party, either in whole or in part, nor use them for purposes other than those for which they were handed over, therefore in general for specific project execution purposes as contractually defined.

4. Regulations in force in the country of destination and safety devices

4.1 The customer shall, at the latest when placing the order, verify that local standards and regulations applicable to the execution of project, to the operation of the plant as well as to the health and safety of personnel are met by equipment and services as offered by the supplier.
4.2 Additional or other safety devices in addition to those defined as per Clause 4.1 shall be supplied to the extent as having been expressly agreed upon.

5. Prices

5.1 Unless otherwise agreed upon, all prices shall be deemed to be net ex works place of supply, freely available in the currency of the offer without any deduction whatsoever.
Any and all additional charges, such as, but not limited to, freight charges, insurance premiums, fees for export, transit, import and other permits, as well as for certifications, shall be borne by the customer unless agreed otherwise in writing. Likewise, the customer shall bear any and all taxes, fees, levies, customs duties and the like which are levied out of or in connection with the contract, or shall refund them to the supplier against adequate evidence in case the disbursement as not been included in the contract price at the time of the order confirmation.
5.2 The supplier reserves the right to adjust prices as a result of rescheduling of the contractually-agreed performance for reasons not solely attributable to the supplier. In addition, an appropriate price adjustment shall apply in case
– the delivery time has been subsequently extended due to any reason stated in Clause 8.3, or
– the nature or the scope of the agreed supplies or services has changed, or
– the material or the execution has undergone changes because any input , either documented or simply verbal, furnished by the customer were not in conformity with the actual circumstances, or were incomplete or unusable.

6. Terms of payment

6.1 Payments shall be made by the customer at supplier's domicile according to the agreed terms of payment, without any deduction for cash discount, expenses, taxes, levies, fees, duties, and the like.
Price shall be paid in accordance with the payment terms stipulated in the order confirmation and shall be deemed to be accomplished as far as the entire amount due, in the applicable currency, has been made freely available to the supplier at supplier's domicile.
6.2 The dates of payment shall also be observed if transport, delivery, erection, commissioning or taking over of the supplies or services is delayed or prevented due to reasons not attributable solely to the supplier, or if minor parts are missing, or if postdelivery work is to be carried out without the supplies being prevented from use.
6.3 If the advance payment and/or any contractually agreed security is not delivered in accordance with the terms of the contract, the supplier shall be entitled to terminate the contract and shall be entitled to claim compensation for expenditures and losses caused by material breach of contract.
6.4 If the customer, for any reason whatsoever, is in delay with a payment, or part of it, or if the supplier has evidence that it will not receive payments in total or in due time because of circumstances having taken place after the order confirmation, the supplier, without being limited in its rights provided for by law, shall be entitled, without any restriction, to refuse any further performance of the contract and to retain the supplies ready for dispatch until payments have been performed or until the supplier have received satisfactory credit securities. If such resolution cannot be reached within a reasonable time, or in case the supplier does not receive adequate securities, the supplier shall be entitled to terminate the contract and shall be entitled to claim compensation for expenditures and losses caused by material breach of contract.
6.5 If the customer delays in the agreed terms of payment, it shall be liable, without reminder, for interest with effect from the agreed date on which the payment was due at a rate as defined in the technical/commercial offer. The right to claim further damages is regulated via Clause 6.4.

7. Reservation of title

The supplier shall remain the owner of all supplies until having received the full payments in accordance with the contract.
The customer shall cooperate in any measures necessary for the protection of supplier's title. In particular upon entering into the contract it authorises the supplier to enter or notify the reservation of title in the required form in public registers, books or similar records, all in accordance with relevant national laws, and to fulfil all corresponding formalities, at customer's cost.
During the period of the reservation of title, the customer shall, at its own cost, maintain the supplies and insure them for the benefit of the supplier against theft, breakdown, fire, water and other risks. It shall further take all measures to ensure that the supplier's title is in no way prejudiced.

8. Delivery time

8.1 The delivery time shall start as soon as: the order confirmation is issued, all official formalities such as, but not limited to, import, export, transit and payment permits have been completed, payments due with the order have been made, any contractually agreed credit security is confirmed at the supplier’s benefit and all needed technical points settled. The delivery time shall be deemed to be observed if by that time the supplier has sent a notice to the customer informing that the supplies are ready for dispatch.
8.2 Compliance with the delivery time is conditional upon customer's fulfilling all its contractual obligations.
8.3 The delivery time is reasonably extended:
a) if the information required by the supplier for performance of the contract is not received in time, or if the customer subsequently changes it thereby causing a delay in the delivery of the supplies or services;
b) if hindrances occur which the supplier cannot prevent despite using the required care, regardless of whether they affect , as a result of a force major event, the supplier or the customer or a third party. Such hindrances include, but shall not be limited to, epidemics, mobilisation, war, revolution, serious breakdown in the works, accidents, labour conflicts, late or deficient delivery by subcontractors of raw materials, semifinished or finished products, the need to scrap important work pieces, official actions or omissions by any state authorities or public bodies, natural catastrophes, acts of God;
c) if the customer or a third party is behind schedule with work it has to execute, or with the performance of its contractual obligations, in particular if the customer fails to observe the terms of payment.
8.4 The customer shall be entitled to claim liquidated damages for delayed delivery in so far as it can be proved that the delay has been caused exclusively by the fault of the supplier. Liquidated damages for delayed delivery shall be limited at one per cent of the value of the supplies in delay for every full week of delay capped at ten per cent of the purchase order price of the supplies in delay. A grace period shall be granted for the first week of delay. The agreed liquidated damages are the entire reparation due to delay in delivery. If substitute material can be supplied to accommodate the customer’s needs, the latter is not entitled to any liquidate damages for delay.
After reaching the maximum liquidated damages for delayed delivery, the customer shall grant the supplier a reasonable extension of time in writing. If such extension is not observed for reasons within supplier's control, the customer shall have the right to reject the delayed part of the supplies or services.
8.5 In case a specific date instead of a delivery period is fixed, such date shall correspond to the last day of a delivery period; Clauses 8.1 to 8.4 apply by analogy. Any delivery date agreed in the contractual documentation shall be construed as the best appraisal of the availability of the equipment for delivery and any “time is of the essence” interpretation shall be waived.
8.6 Any delay of the supplies or services does not entitle the customer to any rights and claims other than those expressly stipulated in this Clause 8.

9. Packing

If not included in the offer, packing shall be charged for separately by the supplier and shall not be returnable. However, if it is declared as supplier's property, it shall be returned by the customer, carriage paid, to the place of dispatch.

10. Passing of risk

10.1 The risk of the supplies shall pass to the customer by the date of their leaving the works.
10.2 If dispatch is delayed at the request of the customer or due to reasons beyond supplier's control, the risk of the supplies shall pass to the customer at the time originally foreseen for their leaving the works. From this moment on, the supplies shall be stored and insured on the account and at the risk of the customer.

11. Forwarding, transport and insurance

11.1 The supplier shall in time be notified of special requirements regarding forwarding, transport and insurance. The transport shall be at customer's expense and risk.
Objections regarding forwarding or transport shall upon receipt of the supplies or of the shipping documents be immediately submitted by the customer to the last carrier.
11.2 The customer shall be responsible for taking all-risk insurance against transport and erection of the equipment.

12. Inspection and taking-over of the supplies and services

12.1 As far as being normal practice, the supplier shall inspect the supplies and services before dispatch. If the customer requests further testing, this has to be specially agreed upon and paid for by the customer.
12.2 The customer shall inspect the supplies and services within a reasonable period and shall immediately notify the supplier in writing of any deficiencies. If the customer fails in doing so, the supplies and services shall be deemed to have been taken over.
12.3 Having been notified of deficiencies according to Clause 12.2, the supplier shall as soon as possible remedy them, and the customer shall give the supplier the possibility of doing so. After remedy of such deficiencies, a take-over test according to Clause 12.4 will be carried out at the request of the customer or of the supplier.
12.4 Subject to Clause 12.3 and in absence of a specific take-over test procedures defined before the order confirmation, the following terms shall apply:
– The supplier shall advise the customer in time of the execution of the take-over test so that the customer or its representative can attend.

– A take-over report shall be prepared which shall be signed by both the customer and the supplier or by their representatives. Such report shall state that take-over has taken place, or, if applicable, that it has taken place under reservations, or that the customer has refused the acceptance. In the last two cases, the deficiencies shall be listed individually in the report.
– In case of minor deficiencies, in particular those which do not critically hinder the basic functionality of the equipment, the customer shall not be entitled to refuse the acceptance of the supplies or services and the signature of the take-over report. The supplier shall remedy such deficiencies without delay.
– In case of material deviations from the guaranteed contractual performance the customer shall give the supplier the possibility, via appropriate measures, of remedying the critical shortfalls within a reasonable time. Thereafter a further take-over test shall be planned and performed. If the repeated test still evidences material deviations from the contract, the customer shall be entitled to claim either a price reduction or, in case of deficiencies crucially impairing the performance of the complete plant, then the customer shall be entitled to refuse acceptance of the defective part or, if partial acceptance is unviable, to terminate the contract. In such case the supplier can only be held liable to reimburse the sums which have been paid to it for the parts affected by the termination.
12.5 The Take-over shall also be deemed completed
– if the take-over test cannot be carried out in the planned period for reasons beyond supplier's control;
– if the customer refuses the acceptance without material evidences;
– if the customer enters into commercial operation with the equipment delivered as such;
– if the customer modifies and/or alter the equipment without an agreement with the supplier;
12.6 Deficiencies and/or deviations of any kind in the equipment or services shall not entitle the customer to any rights and claims other than those expressly stipulated in Clauses 12.4 and 13 (guarantee, liability for defects).

13. Guarantee, liability for defects

13.1 The guarantee period(s), guaranteed performance and relevant guarantee basis are explicitly defined in the technical-commercial offer for the project and attached documentation. The guarantee period starts when the supplies leave the works or at the take-over of the equipment as agreed. Delays in dispatching, taking-over or erection due to reasons beyond supplier's control shall not prejudice the guarantee period. For replaced or repaired parts the guarantee period starts anew and lasts 6 months after replacement or completion of the repair or taking-over, but not longer than the expiry of a period being equal to the guarantee period stipulated in the preceding paragraph.
The guarantee expires as soon as the customer or a third party undertakes modifications and/or repairs and/or maintenance activities not agreed in writing with the supplier or if the customer, in case of a defect, does not immediately take all appropriate steps to mitigate the flaw and give the supplier the possibility of remedying such defect.
13.2 Upon written request of the customer, the supplier undertakes at its choice to repair or replace parts of the supplies which, before the expiry of the guarantee period, are proved to be defective in materials or workmanship.
The supplier shall bear the costs of remedying the defective parts in its works. If the repair cannot be carried out in supplier's works, the customer shall bear the related costs of transport, personnel, travelling, living, dismantling and reassembly of the defective parts. Correction by the supplier of defective parts, in the manner and for the period of time provided above, shall constitute the whole and exclusive fulfilment of all liabilities of the seller for such non-conformities, whether based on contract, warranty, negligence, indemnity, strict liability or otherwise.
13.3 The seller makes no other warranty, explicit or implicit, except that expressly defined in the technical-commercial offer, and all implied warranties, including any warranty of suitability for specific purposes, are hereby disclaimed
13.4 Excluded from supplier's guarantee and liability are all non-conformities which cannot be proved to have their origin in defective material or faulty workmanship, e.g. those resulting from normal wear, improper maintenance, failure to observe the operating instructions, excessive loading, use of any unsuitable material, influence of chemical or electrolytic action, building or erection work not undertaken by the supplier, or resulting from other reasons beyond supplier's control.
13.5 The whole liability of the seller with respect to the contractual performance and/or omissions and to any other claim related to the design, manufacture and servicing of the offered product, whether based on contract, warranty, negligence, indemnity, strict liability or otherwise, shall in no event exceed the purchase price of the particular component, or unit, of the product giving rise to the claim.
The seller shall, in no event, be liable to the customer or to any beneficiary or assignee of the customer, for any consequential, incidental, indirect, special or punitive damages, whether based upon, but not limited to, lost profits or revenue, interest, impairment of productive assets, shutdown or non-operation, increased expenses of operation, or claims of the customer or end clients for operations interruption, whether or not such loss or damage is based on contract, warranty, negligence, indemnity, strict liability or otherwise.
13.6 With respect to any defective material, design or workmanship as well as to any failure to fulfil express warranties and/or any contractual performance and/or omission, the customer shall not be entitled to any rights and claims other than those expressly stipulated in Clauses 13.1 to 13.5.

14. **Termination of the contract**

Both supplier and customer shall be entitled to terminate the contract, or parts of it, for convenience. In case of termination of the contract the supplier shall be entitled to the full payment of those portions of the supplies and services already accomplished, complete or partial, whether already delivered or not. Finite products and semi-finished materials shall be delivered to the customer if requested. Claims for damages by either party as a consequence of such termination are excluded.

15. **Conflicting provisions and now waiver**

In case of any conflict, the terms and conditions contained herein shall supersede any other stipulation previously agreed between the contractual parties. No other agreement shall be binding unless such amendment is executed in writing by the contractual parties. No waiver of any breach shall be construed as a waiver of any succeeding breach of the same or of any covenant, and in no event shall this provision itself be waived.

16. **Indemnification**

If, through actions or omissions of one party or of persons employed or appointed by it to perform any of its obligations, personal injury or damage to the property of third parties occurs and a claim is raised against such party, then the latter shall be indemnified by the other party.

17. **Jurisdiction and applicable law**

17.1 The place of jurisdiction shall be at Indianapolis, IN
17.2 The contract shall be governed by Indiana law

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
2024 MODEL YEAR
CERTIFICATE OF CONFORMITY
WITH THE CLEAN AIR ACT

OFFICE OF TRANSPORTATION AND AIR QUALITY
ANN ARBOR, MICHIGAN 48105

Certificate Issued To: **INNIO Jenbacher GmbH & CO OG**
(U.S. Manufacturer or Importer)

Certificate Number: RGJRB124.620-001

Effective Date: 07/27/2023

Expiration Date: 12/31/2024

Byron J. Bunker, Division Director
Compliance Division

Issue Date: 07/27/2023

Revision Date: N/A

Manufacturer: INNIO Jenbacher GmbH & CO OG
Engine Family: RGJRB124.620
Mobile/Stationary Certification Type: Mobile
Fuel : Natural Gas (CNG/LNG)
Emission Standards :
Mobile Part 1048
NMHC + NOx (g/kW-hr) : 2.7
CO (g/kW-hr) : 4.4
Emergency Use Only :

Pursuant to Section 213 of the Clean Air Act (42 U.S.C. section 7547) and 40 CFR Part 1048, 1065, 1068, and 60 (stationary only and combined stationary and mobile) and subject to the terms and conditions prescribed in those provisions, this certificate of conformity is hereby issued with respect to the test engines which have been found to conform to applicable requirements and which represent the following nonroad engines, by engine family, more fully described in the documentation required by 40 CFR Part 1048 and produced in the stated model year.

This certificate of conformity covers only those new nonroad spark-ignition engines which conform in all material respects to the design specifications that applied to those engines described in the documentation required by 40 CFR Part 1048 and which are produced during the model year stated on this certificate of the said manufacturer, as defined in 40 CFR Part 1048. This certificate of conformity does not cover nonroad engines imported prior to the effective date of the certificate.

It is a term of this certificate that the manufacturer shall consent to all inspections described in 40 CFR 1068.20 and authorized in a warrant or court order. Failure to comply with the requirements of such a warrant or court order may lead to revocation or suspension of this certificate for reasons specified in 40 CFR Part 1048. It is also a term of this certificate that this certificate may be revoked or suspended or rendered void *ab initio* for other reasons specified in 40 CFR Part 1048.

This certificate does not cover large nonroad engines sold, offered for sale, or introduced, or delivered for introduction, into commerce in the U.S. prior to the effective date of the certificate.

JENBACHER

Technical Description, Rev01

Genset

JGS 620 GS-N.L

Grid Parallel with Island Operation

dyn. GC Profile 1 (150ms/30%)

Volta Grid Mobile Genset JGS 620 J715, 13800V

The ratings in the specification are valid for full load operation at a site installation of 3280 ft (1000 m) and an air intake temperature of T1 < 86F (30C). At T1 > 86F (30C), an output deration of approximately 0.25%/F (0.45%/C) will occur

Electrical output @	86F (PF = 1.0 / 0.86*)	3310 / 3291	kW el.
	@ 104F (PF = 1.0 / 0.86*)	3156 / 3142	kW el.
	@ 122F (PF = 1.0 / 0.86*)	3002 / 2995	kW el.
	@ 77F (PF = 1.0 / 0.84*)	3310 / 3288	kW el.

* = PF for full load operation must be limited to the value stated when operating at given temperature

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0.01 Technical Data (at genset) (@ 86 F)

			100%	75%	50%
Power input	[2]	MBTU/hr	26,027	20,196	14,156
Gas volume	*)	SCFH	28383	22024	15437
Mechanical output	[1]	bhp	4,601	3,450	2,300
Electrical output	[4]	kW el.	3,310	2,471	1,626
Heat to be dissipated (calculated with Glycol 50%)	**[5]**				
~ Intercooler 1st stage (Hot water circuit)	[9]	MBTU/hr	3,770	2,229	915
~ Intercooler 2nd stage (Low Temperature circuit)		MBTU/hr	904	574	382
~ Lube oil (with gearbox) (Hot water circuit)		MBTU/hr	1,174	1,013	867
~ Jacket water		MBTU/hr	2,013	1,709	1,402
~ Surface heat	ca. [7]	MBTU/hr	940	~	~
Spec. fuel consumption of engine electric	[2]	BTU/kWel.hr	7,864	8,172	8,704
Spec. fuel consumption of engine	[2]	BTU/bhp.hr	5,657	5,853	6,155
Lube oil consumption	ca. [3]	gal/hr	0.21	~	~
Electrical efficiency			43.4%	41.8%	39.2%
Fuel gas LHV *(See Annex TS1 for Typical Fuel)*		BTU/scft	917		

*) approximate value for pipework dimensioning
[ ] Explanations: see 0.10 - Technical parameters

All heat data is based on standard conditions according to attachment 0.10. Deviations from the standard conditions can result in a change of values within the heat balance and must be taken into consideration in the layout of the cooling circuit/equipment (intercooler; emergency cooling; ...).

Main dimensions and weights (skid mounted engine/gearbox /generator)

Length	in	~ 420
Width	in	~ 90
Height	in	~ 110
Weight empty	lbs	~ 79,480
Weight filled	lbs	~ 81,800

Connections

Hot water inlet and outlet [A/B]	in/lbs	4"/145
Exhaust gas outlet [C]	in/lbs	25"/145
Fuel Gas (at genset) [D]	in/lbs	4"/145
Water drain ISO 228	G	½"
Condensate drain	in	~
Safety valve - jacket water ISO 228 [G]	in/lbs	2x1½"/2.5
Lube oil replenishing (pipe) [I]	in	1.1
Lube oil drain (pipe) [J]	in	1.1
Jacket water - filling (flex pipe) [L]	in	0.5
Intercooler water-Inlet/Outlet 1st stage	in/lbs	4"/145
Intercooler water-Inlet/Outlet 2nd stage [M/N]	in/lbs	2½"/145

Output / fuel consumption

ISO standard fuel stop power ICFN	bhp	4,601
Mean effe. press. at stand. power and nom. speed	psi	319
Fuel gas type		Natural gas
Based on methane number | Min. methane number	MN	80 | 70 d)
Compression ratio	Epsilon	10.5
Min. fuel gas pressure for the pre chamber	psi	60.77081306
Min./Max. fuel gas pressure at inlet to gas train	psi	58.02 - 116.03 c)
Max. rate of gas pressure fluctuation	psi/sec	0.145
Maximum Intercooler 2nd stage inlet water temperature	°F	104
Spec. fuel consumption of engine	BTU/bhp.hr	5,657
Specific lube oil consumption	g/bhp.hr	0.15
Max. Oil temperature	°F	~ 176
Jacket-water temperature max.	°F	~ 203
Filling capacity lube oil (refill)	gal	~ 202

c) Lower gas pressures upon inquiry
d) based on methane number calculation software AVL 3.2 (calculated without N2 and CO2)
e) See TA 1000-1109 for Jenbacher approved SAE 40 oils.

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0.02 Technical data of engine

Manufacturer		JENBACHER
Engine type		J 620 GS-J715
Working principle		4-Stroke
Configuration		V 60°
No. of cylinders		20
Bore	in	7.48
Stroke	in	8.66
Piston displacement	cu.in	7,613
Nominal speed	rpm	1,500
Mean piston speed	in/s	433
Length	in	218
Width	in	75
Height	in	100
Weight dry	lbs	33,069
Weight filled	lbs	35,274
Moment of inertia	lbs-ft²	1642.63
Direction of rotation (from flywheel view)		left
Radio interference level to VDE 0875		N
Starter motor output	kW	20
Starter motor voltage	V	24

Thermal energy balance

Power input	MBTU/hr	26,027
Intercooler	MBTU/hr	4,671
Lube oil (with gearbox)	MBTU/hr	1,174
Jacket water	MBTU/hr	2,013
exhaust when cooling down 356 °F	MBTU/hr	3,514
exhaust when cooling down 212 °F	MBTU/hr	5,029
Surface heat	MBTU/hr	460 + 48

Exhaust gas data

Exhaust gas temperature at (100% / 75% / 50%) load	[8]	°F	682 / 783 / 891
Exhaust gas mass flow rate, wet		lbs/hr	40,996 / 30,485 / 20,441
Exhaust gas mass flow rate, dry		lbs/hr	38,481 / 28,530 / 19,071
Exhaust gas volume, wet		SCFH	518,268 / 385,700 / 258,887
Exhaust gas volume, dry		SCFH	468,158 / 346,819 / 231,625
Max.admissible exhaust back pressure after y-pipe		psi	0.725

Combustion air data

Combustion air mass flow rate	lbs/hr	39,783 / 29,541 / 19,779
Combustion air volume	SCFM	8,213 / 6,099 / 4,083
Max. admissible pressure drop at air-intake filter	psi	0.145

base for exhaust gas data: natural gas: 100% CH4; biogas 65% CH4, 35% CO2

Sound pressure level

Aggregate a)			dB(A) re 20µPa		101	
31,5	Hz		dB		88	
63	Hz		dB		95	
125	Hz		dB		101	
250	Hz		dB		99	
500	Hz		dB		94	
1000	Hz		dB		93	
2000	Hz		dB		92	
4000	Hz		dB		94	
8000	Hz		dB		95	
Exhaust gas b)			dB(A) re 20µPa		123	
31,5	Hz		dB		112	
63	Hz		dB		121	
125	Hz		dB		131	
250	Hz		dB		119	
500	Hz		dB		117	
1000	Hz		dB		118	
2000	Hz		dB		117	
4000	Hz		dB		112	
8000	Hz		dB		98	

Sound power level

Aggregate	dB(A) re 1pW	122
Measurement surface	ft²	1,345
Exhaust gas	dB(A) re 1pW	131
Measurement surface	ft²	67.60

a) average sound pressure level on measurement surface in a distance of 3.28ft (converted to free field) according to DIN 45635 and ISO 3744, precision class 3.
b) average sound pressure level on measurement surface in a distance of 3.28ft according to DIN 45635 and ISO 3744, precision class 2.
The spectra are valid for aggregates up to bmep=290.07548 psi. (for higher bmep add safety margin of 1dB to all values per increase of 15 PSI pressure).
Engine tolerance ± 3 dB

0.02.01 Technical data of gearbox

Manufacturer		EISENBEISS
Type		~
Gearbox ratio		1:1.2
Efficiency	%	99.59
Mass	lbs	4,974

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*0.03 Technical data of generator

Manufacturer		AVK e)
Type		DIG 142 d/4 e)
Driving power	bhp	4,582
Ratings at p.f.= 1.0	kW	3,310
Ratings at p.f. = 0.86	kW	3,291
Rated output at p.f. = 0.86	kVA	3,822
Rated reactive power at p.f. = 0.86	kVAr	1,943
Rated current at p.f. = 0.86	A	160
Frequency	Hz	60
Voltage	kV	13.8
Speed	rpm	1,800
Permissible overspeed	rpm	2,250
Power factor (lagging - leading) (UN)		0,86 - 0,95
Efficiency at p.f.= 1.0		96.86%
Efficiency at p.f. = 0.86		96.3%
Moment of inertia	lbs-ft²	3916.11
Mass	lbs	21,716
Radio interference level to EN 55011 Class A (EN 61000-6-4)		N
Cable outlet		left
Ik" Initial symmetrical short-circuit current	kA	1.26
Is Peak current	kA	3.22
Insulation class		H (F for Pilot Unit 1)
Temperature rise (at driving power)		F
Maximum type rating ambient temperature	°F	104

Reactance and time constants at rated output (saturated)

xd direct axis synchronous reactance	p.u.	1.883
xd' direct axis transient reactance	p.u.	0.248
xd" direct axis sub transient reactance	p.u.	0.156
x2 negative sequence reactance	p.u.	0.175
Td" sub transient reactance time constant	ms	28
Ta Time constant direct-current	ms	50
Tdo' open circuit field time constant	s	3.25

e) JENBACHER reserves the right to change the generator supplier and the generator type. The contractual data of the generator may thereby change slightly. The contractual produced electrical power will not change.

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connection variant 1KF1 @ 86F

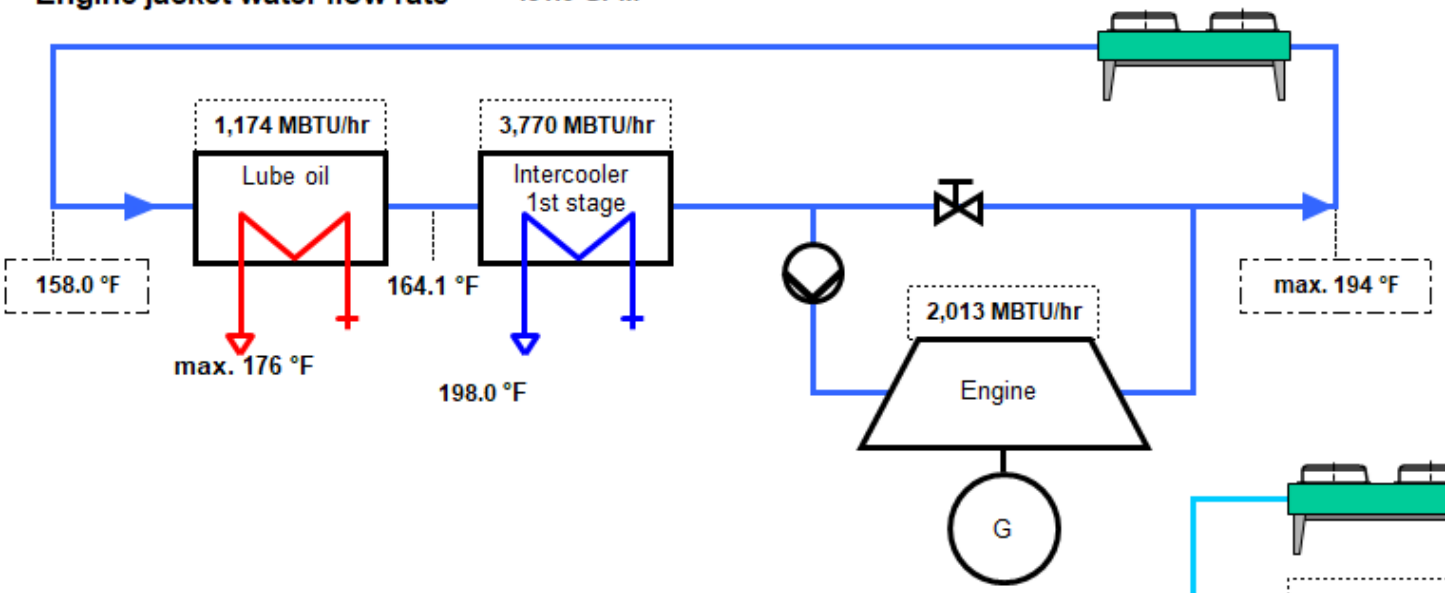
J 620 GS- J715

* Engine jacket water cooling circuit (calculated with Glycol 50%)

Heat to be dissipated = 6,957 MBTU/hr

(+12/-8 % tolerance)

Engine jacket water flow rate = 451.0 GPM

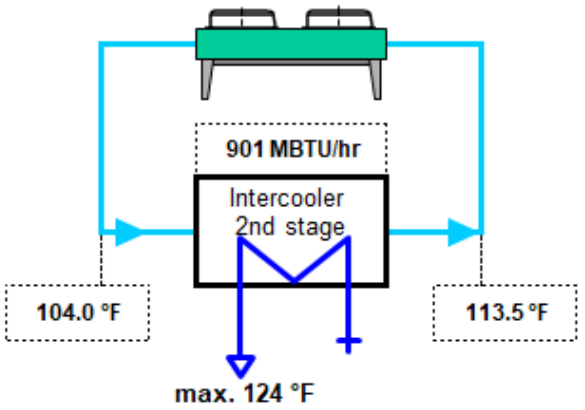


* Low Temperature circuit (calculated with Glycol 50%)

Heat to be dissipated = 901 MBTU/hr

(+12/-8 % tolerance)

Cooling water flow rate = 220.0 GPM



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Cooling Coil Design Data Connection Variant 1KF1

Design data cooling coil

Oil cooler integrated:

US UNITS

Engine Power	100	%	95.45	%	90.91	%
Ambient Temperature	86	°F	104	°F	122	°F
HT circuit (Thermal + 12%)*	7790	mbtu/h	7675	mbtu/h	7467	mbtu/h
Inlet temperature	195	°F	198	°F	201	°F
Outlet temperature	158	°F	162	°F	165.2	°F
fluid flow	result	GPM	result	GPM	result	GPM
Glycol %	50	%	50	%	50	%
max. pressure drop	4.35	psi	4.35	psi	4.35	psi
LT circuit (Thermal + 12%)*	1011	mbtu/h	878	mbtu/h	793	mbtu/h
Inlet temperature	result	°F	result	°F	result	°F
Outlet temperature	104	°F	122	°F	140	°F
fluid flow	220	GPM	220	GPM	220	GPM
Glycol %	50	%	50	%	50	%
max. pressure drop	10	psi	10	psi	10	psi

METRIC

Engine Power	100	%	95.45	%	90.91	%
Ambient Temperature	30	°C	40	°C	50	°C
HT circuit (Thermal + 12%)*	2283	KW	2247	KW	2186	KW
Inlet temperature	91	°C	92	°C	94	°C
Outlet temperature	70	°C	72.2	°C	74	°C
fluid flow	result	m3/h	result	m3/h	result	m3/h
Glycol %	50	%	50	%	50	%
max. pressure drop	0.3	bar	0.3	bar	0.3	bar
LT circuit (Thermal + 12%)*	296	KW	257	KW	232	KW
Inlet temperature	result	°C	result	°C	result	°C
Outlet temperature	40	°C	50	°C	60	°C
fluid flow	50	m3/h	50	m3/h	50	m3/h
Glycol %	50	%	50	%	50	%
max. pressure drop	0.7	bar	0.7	bar	0.7	bar

* HT and LT values based on generated thermal +12%

0.05 Cooling water circuit

Oil - heat (Hot water circuit)

Nominal output	MBTU/hr	1,174
Max. Oil temperature	°F	176
Loss of nominal pressure of cooling water	psi	5.80
Safety valve - max press. set point	psi	50.76

Engine jacket water - heat (Hot water circuit)

Nominal output	MBTU/hr	2,013
Max. engine jacket water temperature (outlet engine)	°F	197
Engine jacket water flow rate	GPM	451.0
Safety valve - max press. set point	psi	50.76

Mixture Intercooler (1st stage) (Hot water circuit)

Nominal output	MBTU/hr	3,770
Max. inlet cooling water temp. (intercooler)	°F	164.4
Design pressure of cooling water / (max. operating pressure)	lbs	145
Loss of nominal pressure of engine jacket water	psi	7.25
Safety valve - max press. set point	psi	50.76

Mixture Intercooler (2nd stage) (Low Temperature circuit)

Nominal output	MBTU/hr	901
Max. inlet cooling water temp. (intercooler)	°F	104
Aftercooler water flow rate	GPM	220.0
Design pressure of cooling water / (max. operating pressure)	lbs	145
Intercooler water pressure drop	psi	8.70
Safety valve - max press. set point	psi	50.76

The final pressure drop will be given after final order clarification and must be taken from the P&ID order documentation.

0.10 Technical parameters

The following “Technical Instruction (TA) of JENBACHER” form an integral part of the contract and must be strictly observed:

TA 1000-0004 - Preservation of Jenbacher modules
TA 1100-0110 – Boundary Conditions for Jenbacher Gas Engines
TA 1100-0111 – General Conditions – Operation and Maintenance
TA 1100-0112 – Installation of Jenbacher Units

These Technical Instructions reference other guides and instructions which can be provided upon request. These instructions should be carefully reviewed by all personnel involved with the application, installation design, installation construction, and overall maintenance of any Jenbacher gas engine

All data in the technical specification are based on engine full load (unless stated otherwise) at specified temperatures as well as the methane number and subject to technical development and modifications. For isolated operation an output reduction may apply according to the block load diagram. Before being able to provide exact output numbers, a detailed site load profile needs to be provided (motor starting curves, etc.).

All pressure indications are to be measured and read with pressure gauges (psig).

[1] At nominal speed and standard reference conditions ICFN according to ISO 3046-1, respectively.
[2] According to ISO 3046-1, respectively, with a tolerance of +**5** %.
Efficiency performance is based on a new unit (immediately upon commissioning).Effects of degradation during normal operation can be mitigated through regular service and maintenance work.

[3] Average value between oil change intervals according to maintenance schedule, without oil change amount
[4] At p. f. = 1.0 according to IEC 60034-1:2017 with relative tolerances, all direct driven pumps are included
[5] Total output with a tolerance of +12/-8 %
[6] According to above parameters [1] through [5]
[7] As a guiding value at p.f. 0.86 and only valid for (engine, generator, TCM). Other peripheral equipment is not considered.
[8] Exhaust temperature with a tolerance of ±8 %
Note: an optimized operating mode to minimize methane slip can result in changed exhaust gas data (exhaust gas temperature, NOx emissions, etc.) and must be taken into account in the design of the exhaust gas aftertreatment
[9] Intercooler heat on:
*** standard conditions** - If the turbocharger design is done for air intake temperature > 86°F w/o de-rating, the intercooler heat of the 1st stage need to be increased by 2%/K starting from 77°F. Deviations between 77 – 86°F will be covered with the standard tolerance.

Radio interference level
The ignition system of the gas engines complies the radio interference levels of CISPR 12 and EN 55011 class B, (30-75 MHz, 75-400 MHz, 400-1000 MHz) and (30-230 MHz, 230-1000 MHz), respectively.

Definition of output
- ISO-ICFN continuous rated power:
  Net break power that the engine manufacturer declares an engine is capable of delivering continuously, at stated speed, between the normal maintenance intervals and overhauls as required by the manufacturer. Power determined under the operating conditions of the manufacturer's test bench and adjusted to the standard reference conditions.
- Standard reference conditions:
  Barometric pressure: 14.5 psi (1000 mbar) or 328 ft (100 m) above sea level
  Air temperature: 77°F (25°C) or 298 K
  Relative humidity: 30 %

- Volume values at standard conditions (fuel gas, combustion air, exhaust gas)
  Pressure: 1 atmosphere (1013.25 mbar)
  Temperature: 32°F (0°C)

Loss of engine performance
a) Performance reduction due to gas quality
If the reference methane number is not reached and the knock control responds, the ignition timing at full performance is adjusted in conjunction with the engine management system; only then is performance reduced.
H2 admixtures in the range of 3–5 Vol% into the natural gas network are generally regarded as non-critical. Prerequisites for this are rates of change according to TA 1000-0300, as well as the knock resistance (minimum methane number) of the natural gas-H2 mixture according to the specification. For reliable compliance with required NOx emissions, the JENBACHER LEANOX^{plus} control is recommended (measurement of NOx emissions and correction of the LEANOX controller). Higher H2 addition rates into the natural gas network must be assessed on a project-specific basis.

b) Performance reduction due to voltage and frequency limits
If the voltage and frequency limits for generators specified in IEC 60034-1 Zone A are exceeded, performance is reduced.

c) Performance reduction due to environmental conditions
As a mobile unit, site conditions of elevation and engine air intake temperature (T1) will influence the turbo-charger performance and resultant full load output capabilities.

The engine generator set guaranteed base full output rating is based on an elevation of 3280 ft (1000m) and an air intake temperature of T1 < 86F (30 C) (see cover page and 3280 ft (1000m) elevation below)

The following deration statements consider the effects of elevation on the guarantee full output rating;

- **<u>Site Elevation < 1640 ft (500 m)</u>**
  For site elevations of < 1640 ft (500 m), 100% full load operations can occur provided engine ambient air intake temperatures are T1 < 104 F (40C). At air intake temperatures of T1 > 104 F (40C), a full load output deration of approximately 0.25%/F (0.45%/C) will occur.

- **1640 ft (500 m) < Site Elevation < 3280 ft (1000 m)**
  For site elevations between 1640 ft (500 m) and 3280 ft (1000 m), 100% full load operations can occur provided the maximum air intake temperatures is adjusted based on the relationship of

  T1 < (104F – (1 F for every 91 ft above 1640 ft))
  T1 < (40C – (1 C for every 50 m above 500 m)).

  Summarized:
  - At 1640 ft (500 m), 100% full genset output can be achieved up to an air intake temperature of T1 < 104 F (40 C).
  - At 2460 ft (750 m), 100% full genset output can be achieved up to an air intake temperature of T1 < 95F (35 C).
  - At 3280 ft (1000 m), 100% full genset output can be achieved up to an air intake temperature of T1 < 86F (30 C).

  At the noted elevation, should the noted T1 maximum be exceeded, a full load output derating of approximately 0.25%/F (0.45%/C) will occur for T1 > max temp.

- **Site Elevation = 3280 ft (1000 m) (Guarantee Point)**
  At a site elevation of 3280 ft (1000 m), 100% Full genset operation will occur at an air intake temperature of T1 < 86F (30 C). At T1 > 86 F (30C), a full load output deration of approximately 0.25%/F (0.45%/C) will occur.

- **3280 ft (1000 m) < Site Elevation < 5905 ft (1800 m)**
  For site elevations between 3280 ft (1000 m) and 5905 ft (1800 m), full genset output operations must be derated. The relationship for elevations effect on engine full load capability is the relationship

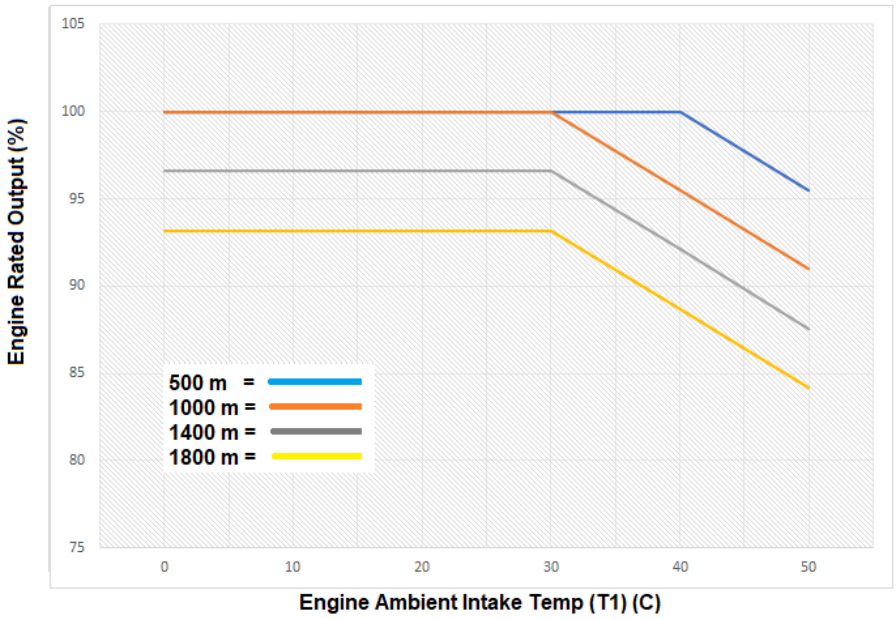
  Full Load Output = 100% - (0.85% for every 328 ft above 3280 ft)
  Full Load Output = 100% - (0.85% for every 100m above 1000m)

  The full load output will occur at an engine ambient air intake temperatures of T1 < 86 F(30 C).

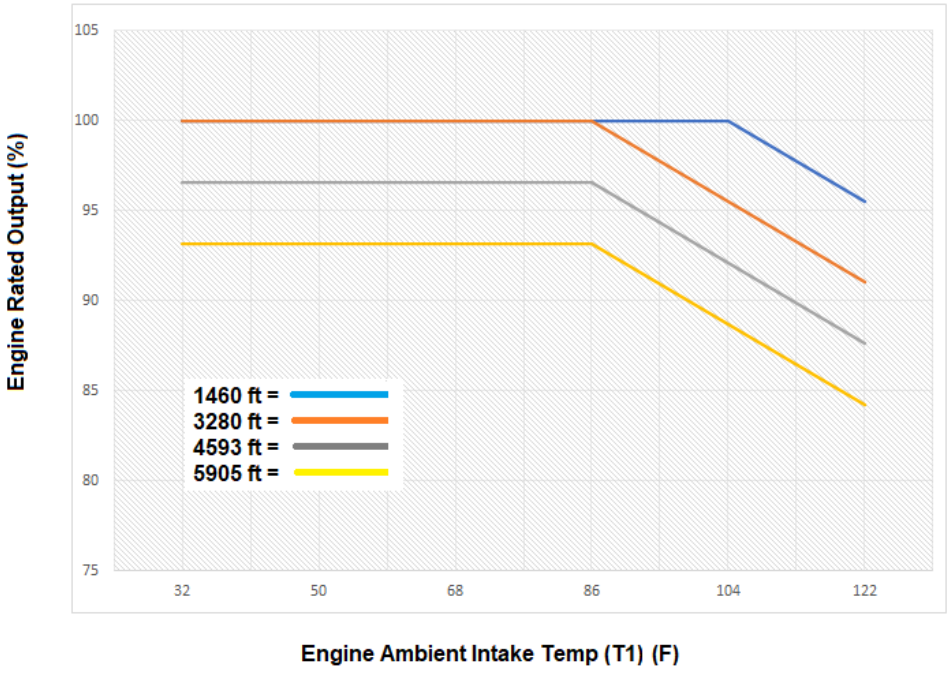
  Summarized:
  - At 3280 ft (1000 m) and an engine air intake temperature T1 < 86 F (30 C), standard 100% full output will be possible
  - At 4593 ft (1400 m) and an engine air intake temperature T1 < 86F (30 C), full output will be 96.6% of the standard rating.
  - At 5905 ft (1800 m) and an engine air intake temperature T1 < 86 F (30 C), full output will be 93.2% of the standard rating.

  At the noted elevation, should air intake temperature be T1 > 86 F (30 C), the noted output rating will derate by approximately 0.25%/F (0.45%/C).

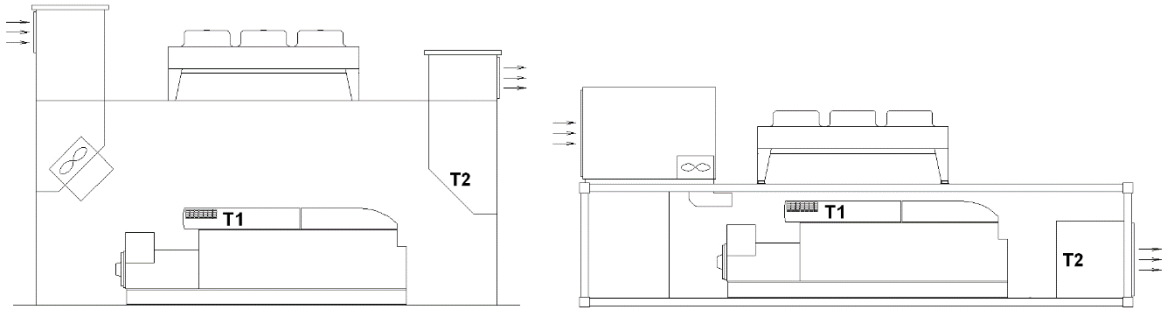
Mobile Unit Output Derating Curve (%/C)



Mobile Unit Output Derating Curve (%/F)



Recommended Engine room outlet temperature based on Jenbacher standard package: **131°F** (T2) -> engine stop



The minimum recommended air change ratio (C) must be observed to maintain the required air quality and prevent unwanted gas accumulations (refer to Section ⇨ Potentially explosive Atmospheres as per TA1100-0110). The calculation is based on TA 1100-0110 and is C_{min}= 50h^{-1} for JENBACHER modules.

Parameters for the operation of JENBACHER gas engines
The genset fulfills the limits for mechanical vibrations according to ISO 8528-9.
The following "Technical Instruction of JENBACHER" forms an integral part of a contract and must be strictly observed: **TA 1000-0004, TA 1100 0110, TA 1100-0111**, and **TA 1100-0112.**
Transport by rail should be avoided. See **TA 1000-0046** for further details

Failure to adhere to the requirements of the above-mentioned TA documents can lead to engine damage and may result in loss of warranty coverage.

Parameters for the operation of control unit and the electrical equipment
Relative humidity 50% by maximum temperature of 104°F.
Altitude up to 2000m above the sea level.

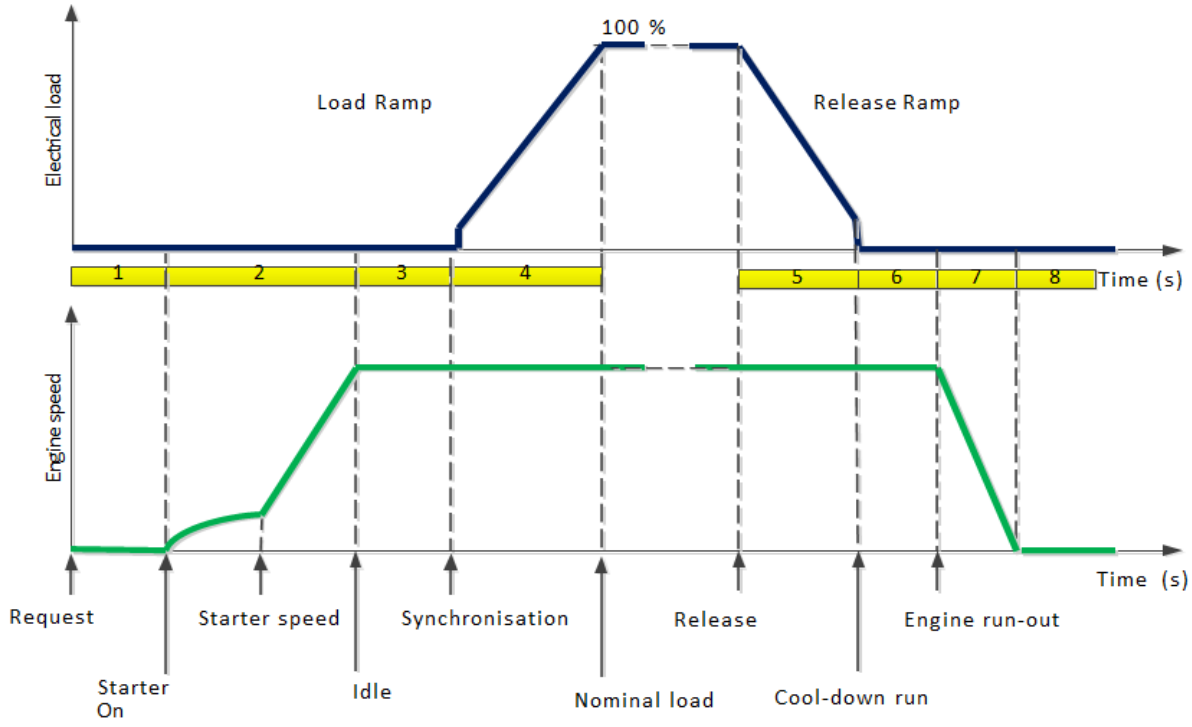
0.20 Mode of Operation

****** Mobile Application capabilites based on Annex 12 - Deviation List, Halliburton Specification D02064380 Revision A 221108***

0.20.01 Guide values for genset - start/stop times and el. load ramps

Basic boundary conditions for engine start:

Engine conditions	Oil temperature (°C / °F)	Cooling-water temperature (°C / °F)
Fast start release	> 27 / 81 (type 3/4/6 engines)	> 55 / 131



The following time data of the individual start sections up to the nominal load are **guide values** for a fully automatic start under preheated conditions. Only the total start time is observed under the various engine conditions. The individual time segments given in the table therefore do not necessarily add up to the indication of the total start time.

Deviations are possible for special designs.

	J208	Type 3	Type 4	Type 612 – 620	J624
(1) Start preparation [1] *)	0	0	20	70	90
(2) Engage starter until reaching nominal speed [s] *)	20	20	25	40	40
(3) Synchronisation [s] *) **)	1-50	1 – 50	1 – 50	1 – 50	1 – 50
(4) Load application up to nominal load [s] *) **)	180	180	180	160	160
Total start-up time from request to nominal load [s]	<300	<300	<300	<300	<330

The following **times for unloading the engine** are guide values for engine/generator combination inertia constant H<1 kWs/kVA (with LS, CGT, TDPS generators) and the hot operating condition.

(5) Load reduction ramp [s]	160	160	160	160	120
(6) Cool-down run [s]	60	60	60	10	10
(7) Run-down [s]	60	60	60	60	60
Total time from nominal load to run-down time [s]	280	280	280	220	180
(8) Blocking time for restart [s]	~100	~100	~100	~200	~400

*) The times for start-up preparation and synchronisation can vary greatly and depend on project specifications.
**) Fast start function and faster load ramps are available on request.

****** Mobile Application capabilites based on Annex 13 - Deviation List, Halliburton Specification D01881854 Revision F 221108***

1.00 Scope of supply - Module

Design:
The module drive train consists of a base engine, flexible coupling, gearbox, and coupling connecting with the generatorThe module is built as a compact package. The engine base is bolted to the gearbox/generator base.
The Engine output shafting is connected through a coupling to a gearbox. A second coupling is then provided connecting the gearbox to the generator. To provide the best possible isolation from the transmission of vibrations, the engine rests on the engine base-frame by means of anti-vibration mounts. The remaining vibrations are eliminated by mounting the complete module (engine and gearbox/generator frames) on isolating pads (e.g. Sylomer). This, in principle, allows for placing of the module to be directly on any floor capable of carrying the static load.

1.01 Spark ignited gas engine

Four-stroke, air/gas mixture turbocharged, aftercooled, with high performance ignition system and electronically controlled air/gas mixture system.
The engine is equipped with the most advanced

LEANOX® LEAN-BURN COMBUSTION SYSTEM

developed by JENBACHER.

1.01.01 Engine design

Engine block
Single-piece crankcase and cylinder block made of special casting; crank case covers for engine inspection, welded steel oil pan. The oil pan is furnished with an electric heating matt for pre-heating under cold ambient conditions.

Crankshaft and main bearings
Drop-forged, precision ground, surface hardened, balanced; main bearings (upper bearing shell: grooved bearing / lower bearing shell: sputter bearing) arranged between crank pins, drilled oil passages for forced-feed lubrication of connecting rods.

Vibration damper
Maintenance free viscous damper

Flywheel
With ring gear for starter motor and additionally screwed on.

Pistons
Two-part steel piston with oil passages for cooling; piston rings made of high-quality material, main combustion chamber specially designed for lean burn operation.

Connecting rods

Drop-forged, heat-treated, big end diagonally split and toothed. Big end bearings (upper bearing shell: sputter bearing / lower bearing shell: sputter bearing) and connecting rod bushing for piston pin.

Cylinder liner
Chromium alloy gray cast iron, wet, individually replaceable.

Cylinder head
Specially designed and developed for JENBACHER-lean burn engines with optimized fuel consumption and emissions; water cooled, made of special casting, individually replaceable; Valve seats and valve guides and spark plug sleeves individually replaceable; exhaust and inlet valve made of high quality material; Pre-chamber with check-valve.

Crankcase breather
Connected to combustion air intake system

Valve train
Camshaft, with replaceable bushings, driven by crankshaft through intermediate gears, valve lubrication by splash oil through rocker arms.

Combustion air/fuel gas system
Motorized carburetor for automatic adjustment according fuel gas characteristic. Exhaust driven turbocharger, mixture manifold with bellows, water-cooled intercooler, throttle valve and distribution to cylinders.

Ignition system
Most advanced, fully electronic high-performance ignition system, external ignition control.
MORIS / SEMIC: Automatically, cylinder selective registration and control of the current needed ignition voltage.

Lubricating system
Gear-type lube oil pump to supply all moving parts with filtered lube oil, pressure control valve, pressure relief valve and full-flow filter cartridges. Cooling of the lube oil is arranged by a heat exchanger.

Engine cooling system
Electrical jacket water pump, complete with distribution pipework and manifolds.

Exhaust system
Turbocharger and exhaust manifold

Exhaust gas temperature measuring
Thermocouple for each cylinder

Electric actuator
For electronic speed and output control

Electronic speed monitoring for speed and output control
By magnetic inductive pick up over ring gear on flywheel

Starter motor
Engine mounted electric starter motor

1.01.03 Engine accessories

Insulation of exhaust manifold:
Insulation of exhaust manifold is easily installed and removed

Sensors at the engine:
- Jacket water temperature sensor
- Jacket water pressure sensor
- Lube oil temperature sensor
- Lube oil pressure sensor
- Mixture temperature sensor
- Charge pressure sensor
- Minimum and maximum lube oil level switch
- Exhaust gas thermocouple for each cylinder
- Knock sensors
- Gas mixer / gas dosing valve position reporting.
- Air Filter DP sensor
- Crankcase pressure sensor

Actuator at the engine:
- Actuator - throttle valve
- Bypass-valve for turbocharger
- Control of the gas mixer / gas dosing valve

1.01.04 Standard tools (per installation)

The tools required for carrying out the most important maintenance work are included in the scope of supply and delivered in a toolbox.

1.02 Generator-Medium Voltage

The 2-bearing generator consists of the main generator (built as rotating field machine), the exciter machine (built as rotating armature machine) and the digital excitation system.
The digital regulator is powered by an auxiliary winding at the main stator or a PMG system

Main components:
- Enclosure of welded steel construction
- Stator core consist of thin insulated electrical sheet metal with integrated cooling channels.
- Stator winding with 2/3 Pitch
- Rotor consist of shaft with shrunken laminated poles, Exciter rotor, PMG (depending on Type) and fan.
- Damper cage

- Excitation unit with rotating rectifier diodes and overvoltage protection
- Dynamically balanced as per ISO 1940, Balance quality G2,5
- Drive end bracket with re greaseable antifriction bearing
- Non-drive end bracket with re grease antifriction bearing
- Cooling IC01 - open ventilated, air entry at non-drive end, air outlet at the drive end side
- Main terminal box includes main terminals for power cables
- Regulator terminal box with auxiliary terminals for thermistor connection and regulator.
- Anti-condensation heater
- 3 PT100 for winding temperature monitoring+3 PT100 Spare
- 2 PT100 for bearing temperature monitoring
- Current transformer for protection and measuring in the star point
  200/5A, 5P10 15VA, 200/5A, 1FS5, 15VA

Electrical data and features:

- Standards: IEC 60034, EN 60034, ISO 8528-3, ISO 8528-9
- Voltage adjustment range: +/- 10 % of rated voltage (continuous)
- Frequency: -6/+4% of rated frequency
- Overload capacity: 10% for one hour within 6 hours, 50% for 30 seconds
- Asymmetric load: max. 8% I2 continuous, in case of fault I2 x t=20
- Altitude: < 1000m
- Max permitted generator intake air temperature: 5°C - 50°C
- Max. relative air humidity: 90%
- Voltage curve THD Ph-Ph: <3% at idle operation and <3% at full load operation with linear symmetrical load
- Generator suitable for parallel operating with the grid and other generators
- Sustained short circuit current at 3-pole terminal short circuit: minimum 3 times rated current for 5 seconds.
- Over speed test with 1.2 times of rated speed for 2 minutes according to IEC 60034

Operation of a generator with an external earth fault relay in a non-earthed (IT) network is limited to a maximum of 200 hours beyond its service life.

Digital Excitation system ABB Unitrol 1010 mounted within the AVR Terminal box with following features:

- Compact and robust Digital Excitation system for Continuous output current up to 10 A (20A Overload current 10s)
- Fast AVR response combined with high excitation voltage improves the transient stability during LVRT events.
- The system has free configurable measurement and analog or digital I/Os. The configuration is done via the local human machine interface or CMT1000
- Power Terminals
  3 phase excitation power input from PMG or auxiliary windings
  Auxiliary power input 24VDC
- Excitation output
- Measurement terminals: 3 phase machine voltage, 1 phase network voltage, 1 phase machine current
- Analog I/Os: 2 outputs / 3 inputs (configurable), +10 V / -10 V
- Digital I/O: 4 inputs only (configurable), 8 inputs / outputs (configurable)

- Serial fieldbus: RS485 for Modbus RTU or VDC (Reactive power load sharing for up to 31 JENBACHER engines in island operation), CAN-Bus for dual channel communication
- Regulator Control modes: Bump less transfer between all modes
  - Automatic Voltage Regulator (AVR) accuracy 0,1% at 25°C ambient temperature
  - Field Current Regulator (FCR)
  - Power Factor Regulator (PF)
  - Reactive Power Regulator (VAR)
- Limiters: Keeping synchronous machines in a safe and stable operation area
  - Excitation current limiter (UEL min / OEL max)
  - PQ minimum limiter
  - Machine current limiter
  - V / Hz limiter
  - Machine voltage limiter
- Voltage matching during synchronization
- Rotating diode monitoring
- Dual channel / monitoring: Enables the dual channel operation based on self-diagnostics and setpoint follow up over CAN communication. As Option available
- Power System Stabilizer (PSS) is available as option. Compliant with the standard IEEE 421.5-2005 2A / 2B, the PSS improves the stability of the generator over the highest possible operation range.
- Computer representation for power system stability studies: ABB 3BHS354059 E01
- Certifications: CE, cUL certification according to UL 508c (compliant with CSA), DNV Class B,

- **Commissioning and maintenance Tool CMT1000** (for trained commissioning/ maintenance personal)
- With this tool the technician can setup all parameters and tune the PID to guarantee stable operation. The CMT1000 software allows an extensive supervision of the system, which helps the user to identify and locate problems during commissioning on site. The CMT1000 is connected to the target over USB or Ethernet port, where Ethernet connection allows remote access over 100 m.
- Main window
  - Indication of access mode and device information.
  - Change of parameter is only possible in CONTROL access mode.
  - LED symbol indicates that all parameters are stored on non-volatile memory.
- Setpoint adjust window
  - Overview of all control modes, generator status, active limiters status and alarms.
  - Adjust set point and apply steps for tuning of the PID.
- Oscilloscope
- 4 signals can be selected out of 20 recorded channels. The time resolution is 50 ms. Save files to your PC for further investigation.
- Measurement
  - All measurements on one screen.

Routine Test

Following routine tests will be carried out by the generator manufacturer

- Measuring of the DC-resistance of stator and rotor windings
- Check of the function of the fitted components (e.g., RTDs, space heater etc.)
- Insulation resistance of the following components
  - Stator winding, rotor winding
  - Stator winding RTDs
  - Bearing RTDs
  - Space heater

- No Load saturation characteristic (remanent voltage)
- Stator voltage unbalance
- Direction of rotation, phase sequence
- High voltage test of the stator windings (2 x Unom. + 1000 V) and the rotor windings (min. 1500 V)

1.03 Module Accessories

Base frame (for Pilot Unit only)
Split Base Frame fabricated with welded structural steel. First frame to mount the engine, jacket water heat exchangers, pumps and engine auxiliaries, the second to mount the gearbox and generator.

Coupling #1
Engine to Gearbox Geislinger Gesilco coupling is provided. The coupling isolates the major sub-harmonics of engine alternating torque from gear box.

Coupling #2
Gearbox to Generator Coupling is provided. This coupling is designed with a torque limiter to couple gear box with alternator.

Coupling housings are required and are to be provided by a 3rd party packager

Design and design validation for anti-vibration mounts, fabricated and installed by a 3rd party packager

Gear box:
A Single-stage spur gear with overhead shaft and closed loop lube oil system, completely mounted on the gearbox/generator base frame. The lube oil heat exchanger is integrated with the Low Temp cooling water circuit. The gear transmission ratio is 1:1.2. Oil volume is approximately 52 gals (196 liters). Pre-heating elements are installed to the oil pan and oil pipework for low ambient conditions.

Exhaust gas connection
A flanged connection is provided that collects the exhaust gas turbocharger output flows, includes flexible pipe connections (compensators) to compensate for heat expansions and vibrations.

Combustion air filter
A Dry type air filter with replaceable filter cartridges is fitted. The assembly includes flexible connections to the fuel mixer/carburetor and service indicator.

Engine control functions:

- The cabinet houses the unit Battery Charger and primary 24VDC Control Power Distribution (breakers, fuses, and terminals) from the unit Batteries
- Distributed PLC Input and Output cards, located in the cabinet, gather all Engine, Gearbox and Generator Control I/O. These cards transmit data via data bus interface to the central engine control of the module control panel located in the A1 cabinet. Data bus is via CAN and B&R Proprietary Data Highway (Data Cables provided by JENBACHER)
- Speed monitoring relays for protection are provided.
- Gas Train I/O Collection, including interface relays and terminals for gas train shutoff valves.
- Transducer for generator functions, such as excitation voltage.

- Door Mounted Emergency Stop Switch with associated Emergency Stop Loop interface relays.
- Miscellaneous control relays, contacts, fuses, etc. for additional control valves, and auxiliaries.
- Interface Terminal Strips

AC Power for engine mounted auxiliaries (heater, pumps, etc.) are routed through a separate J-box mounted on the side M1 cabinet (Box E1). This is done to maintain signal segregation (AC from control)

NOTE: Generator Current Transformer wiring is connected directly to the Generator

Exhaust gas scavenging blower
An exhaust gas scavenging blower is used to scavenge the remaining exhaust gas out of the exhaust gas pipe work, to prevent the appearance of deflagrations.

Function:
Before each start scavenging by blower is done for app. 1 minute (except at black out – start)

Supervisions:
- Scavenging air fan failure
- Scavenging air flap failure

Consisting of:
- Fan
- Exhaust gas flap
- Temperature switch

1.03.01 Engine jacket water system

Closed cooling circuit, consisting of:
- Expansion tank
- Thermostatic valve
- Required pipework on module
- Electrical jacket water pump, including check valve
- Jacket water preheat device

Engine jacket water components required to be installed by packager:
- Filling device (check and pressure reducing valves, pressure gauge)
- Safety valve(s)
- Vents and drains

1.03.02 Automatic lube oil replenishing system

Automatic lube oil replenishing system:

Includes float valve in lube oil feed line, including inspection glass. Electric monitoring system will be provided for engine shut-down at lube oil levels "MINIMUM" and "MAXIMUM". Solenoid valve in oil feed line is only activated during engine operation. Manual override of the solenoid valve, for filling procedure during oil changes is included.

Oil drain
By set mounted cock

Pre-lubrication- and aftercooling oil pump:
Mounted on the module base frame; it is used for pre-lubrication and aftercooling of the turbochargers.
Period of operation: Pre-lubrication: 1 minute both pumps
Aftercooling: 15 minutes from engine stop only the **480**/**277** V pump
Consisting of:
- 1 piece oil pump 1500 W, **480**/**277** V
- 1 piece oil pump 1500 W, 24 V

- Components required to be installed by packager:
- All necessary vents
- Necessary pipework

1.05.02 Gas train >500mbar (7.3psi) (NFPA 37)

Pre-assembled, delivered loose, for installation into gas pipework to the engine.

Consisting of:
- **Main gas train:**
  - Manual shut off valve
  - Gas filter, filter fineness <3µm
  - T-piece to the pre-chamber gas train or pre-chamber gas compressor
  - Gas admission pressure regulator
  - Pressure gauge with push button valve
  - High pressure regulator with safety-cut-off-valve (SAV)
  - Calming distance with reducer
  - Safety-blow-off-valve (SBV)
  - Pressure gauge with push button valve; after pressure regulator
  - Solenoid valves
  - Leakage detector
  - Gas pressure regulator
  - Gas pressure switches (min., max.)
  - TEC JET

The gas train complies with DIN - DVGW regulations.
Maximum distance from TEC JET outlet to gas entry on engine, including flexible connections, is 39,37in (1m).

- **Pre-chamber gas train:**
  - Manual shut off valve
  - Gas filter, filter fineness <3µm
  - Solenoid valves
  - Pressure regulator
  - Calming distance with reducer
  - Pressure gauge with push button valve

Pre chamber gas pressure regulator (incl. stabilization section) assembled at the flexible connection pre chamber gas.

1.07 Painting

- Quality: Oil resistant prime layer
  Synthetic resin varnish finishing coat

- Color:

	Engine:	RAL 6018 (green)
	Base frame:	RAL 6018 (green)
	Generator:	RAL 6018 (green)

Module interface panel: RAL 7035 (light grey)

	Control panel:	RAL 7035 (light grey)

1.11 Engine generator control panel (All-In-One-Cabinet), one per module- DIA.NE XT4 incl. Single synchronization of the generator breaker

Dimensions:

- Height: 91 in (including 8 in pedestal *)
- Width: 48 in *)
- Depth: 24 in *)

Protection class:

- external IP42
- Internal IP 20 (protection again direct contact with live parts)

*) Control panels will be dimensioned on a project specific basis. Actual dimensions will be provided in the preliminary documentation for the project.

Control supply voltage from starter and control panel batteries: 24V DC

Auxiliary equipment supply (by the supplier of the auxiliary equipment supply system)
The following network forms are possible for the supply of the auxiliary equipment. Depending on these, appropriate protective measures are provided:

Standard: TN- S (L1/2/3, N, PE)

- Power supply via the module control cabinet via connection terminals or directly at the 3-pole mains disconnection unit. Protection against electric shock by automatic disconnection with miniature circuit breaker or fuse.
- Additional protection for sockets with fault current breaker (RCD) type A, 30 mA
- Option:
  - According to national requirements or customer wishes, a 4-pole mains disconnecting device can also be used. Especially if the neutral conductor is not considered to be reliably earthed.
  - Downstream outputs for auxiliary equipment with neutral conductors are fused using 2 or 4 poles.

Option: TN-C (L1/2/3, PEN)

- Power supply via the module control cabinet via connection terminals or directly at the 3-pole mains disconnection unit. Protection against electric shock by automatic disconnection with miniature circuit breaker or fuse.
- Additional protection for sockets with fault current breaker (RCD) type A, 30 mA

Option: TT (L1/2/3, N)

- Power supply via the module control cabinet via connection terminals or directly at the 4-pole mains disconnection unit. Protection against electric shock by automatic disconnection through integrated differential current monitoring (RCD) type A.
- Downstream outputs for auxiliary equipment with neutral conductors are fused using 2 or 4 poles.
- Additional protection for sockets with fault current breaker (RCD) type A, 30 mA
- Option:
  - When using frequency converters, an additional differential current monitoring device (RCD) type B is mounted.

Option: IT (L1/2/3, N, PE)

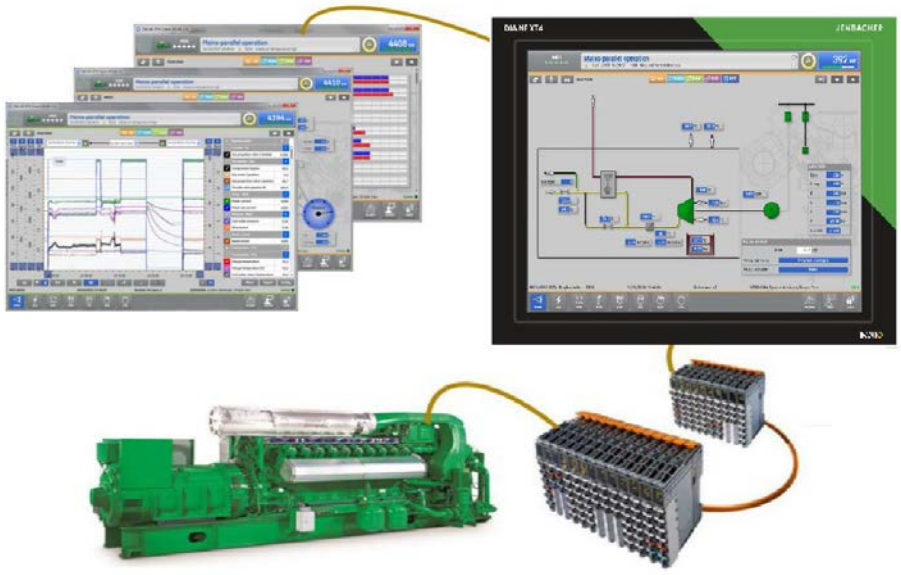
- Power supply via the module control cabinet via connection terminals or directly at the 4-pole mains disconnection unit. Protection against electric shock by automatic disconnection through integrated differential current monitoring (RCD) type A. Insulation monitoring is part of customer's scope of supply. Preparations have already been made for the transfer of error messages to the module control cabinet and alarm signaling via DIA.NE.
- Downstream outputs for auxiliary equipment with neutral conductors are fused using 2 or 4 poles.
- Additional protection for sockets with fault current breaker (RCD) type A, 30 mA
- Option:
  - When using frequency converters, an additional differential current monitoring device (RCD) type B is mounted.
- Option:
  - An insulation monitoring device connected to the auxiliary power supply with automatic disconnection in case of insulation faults. Alarm signaling via DIA.NE.
- Option:

- Overvoltage protection for auxiliary equipment, protection module with integrated remote signaling.
- SPD in conformity with EN 61643-11 type 2
- Nominal voltage Un 230/400V

3 x **480**/**277** V, **60** Hz

Consisting of:
Motor - Management - System DIA.NE

Setup:
- a) Touch display visualization
- b) Central engine and unit control



Touch Display Screen, installed in a dedicated HMI-Cabinet

15“Industrial color graphic display with resistive touch.

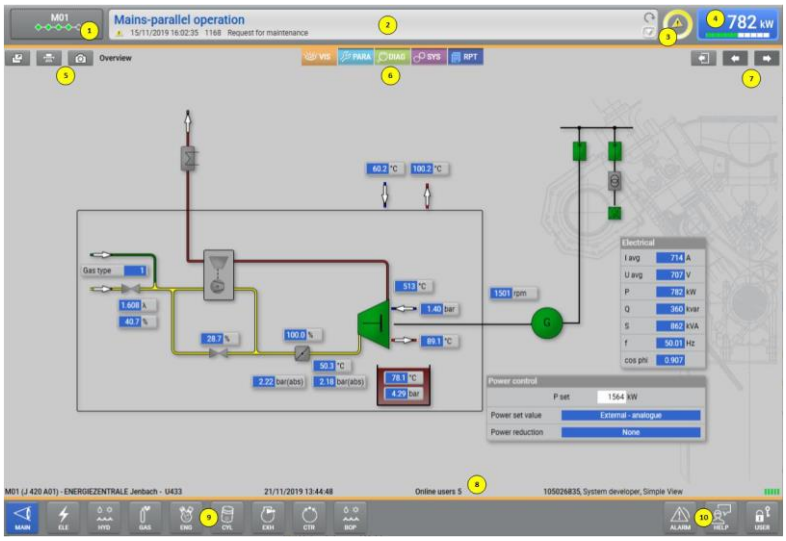
Protection class of DIA.NE XT panel front: IP 65

The screen shows a clear and functional summary of the measurement values and simultaneously shows a graphical summary.

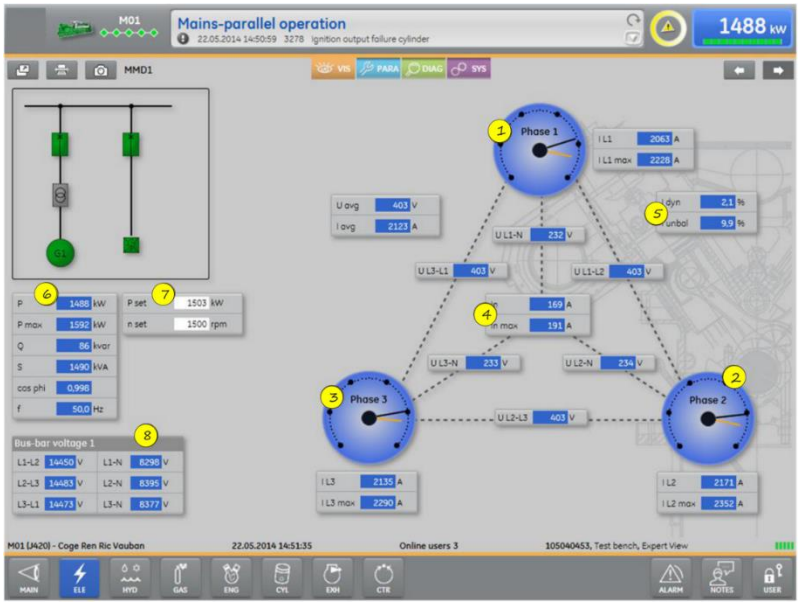
Operation is via the screen buttons on the touch screen
Numeric entries (set point values, parameters…) are entered on the touch numeric pad or via a scroll bar.
Determination of the operation mode and the method of synchronization via a permanently displayed button panel on the touch screen.

Main screens (examples):

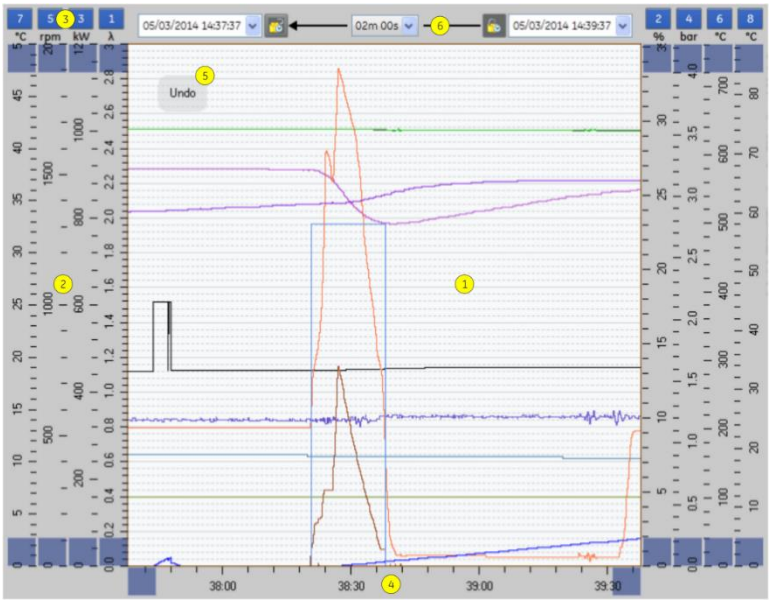
Main: Display of the overview, auxiliaries' status, engine start and operating data.



ELE: Display of the generator connection with electrical measurement values and synchronization status



Trending
Trend with 100ms resolution



Measurement values:

- 500 data points are stored
- Measurement interval = 100ms
- Raw data availability with 100ms resolution: 3 hours + max. 50.000.000 changes in value at shut down (60 mins per shut down)
- Compression level 1: min, max, and average values with 1000ms resolution: 1 day
- Compression level 2: min, max, and average values with 30s resolution: 1 month
- Compression level 3: min, max, and average values with 10min resolution: 10 years

Messages:
1.000.000 message events

Actions (operator control actions):
100.000 Actions

System messages:
100.000 system messages

Central engine and module control:

An industrial PC- based modular industrial control system for module and engine sequencing control (start preparation, start, stop, aftercooling and control of auxiliaries) as well as all control functions.

Interfaces:

- Ethernet (twisted pair) for remote monitoring access
- Ethernet (twisted pair) for connection between engines
- Ethernet (twisted pair) for the Powerlink connection to the control input and output modules.

Connection to the local building management system according to the JENBACHER option list (OPTION)

- MODBUS-RTU Slave
- MODBUS-TCP Slave,
- PROFIBUS-DP Slave (120 words),
- PROFIBUS-DP Slave (190 words),
- ProfiNet Slave
- OPC DA Server

Control functions:

- Speed control in idle and in island mode
- Power output control in grid parallel operation, or according to an internal or external set point value on a case by case basis
- LEANOX control system which controls boost pressure according to the power at the generator terminals, and controls the mixture temperature according to the engine driven air-gas mixer
- Knocking control: in the event of knocking detection, ignition timing adjustment, power reduction and mixture temperature reduction (if this feature is installed)
- Load sharing between engines in island mode operation (option)
- Linear power reduction in the event of excessive mixture temperature and misfiring
- Linear power reduction according to CH4 signal (if available)
- Linear power reduction according to gas pressure (option)
- Linear power reduction according to air intake temperature (option)

Multi-transducer to record the following alternator electrical values:

- Phase current (with slave pointer))
- Neutral conductor current
- Voltages Ph/Ph and Ph/N
- Active power (with slave pointer)
- Reactive power
- Apparent power
- Power factor
- Frequency
- Active and reactive energy counter

Additional 0 (4) - 20 mA interface for active power as well as a pulse signal for active energy

The following alternator monitoring functions are integrated in the multi-measuring device:

- Overload/short-circuit [51], [50]
- Over voltage [59]
- Under voltage [27]
- Asymmetric voltage [64], [59N]
- Unbalance current [46]
- Excitation failure [40]
- Over frequency [81>]
- Under frequency [81<]

Lockable operation modes selectable via touch screen:

- "OFF" operation is not possible, running units will shut down immediately;
- "MANUAL" manual operation (start, stop) possible, unit is not available for fully automatic operation.
- "AUTOMATIC" fully automatic operation according to external demand signal:

Demand modes selectable via touch screen:

- external demand off („OFF“)
- external demand on („REMOTE“)
- overide external demand („ON“)

Malfunction Notice list:

Shut down functions e.g.:

- Low lube oil pressure
- Low lube oil level
- High lube oil level
- High lube oil temperature
- Low jacket water pressure
- High jacket water pressure
- High jacket water temperature
- Overspeed
- Emergency stop/safety loop
- Gas train failure
- Start failure
- Stop failure
- Engine start blocked
- Engine operation blocked
- Misfiring
- High mixture temperature
- Measuring signal failure
- Overload/output signal failure
- Generator overload/short circuit
- Generator over/undervoltage
- Generator over/underfrequency
- Generator asymmetric voltage
- Generator unbalanced load

- Generator reverse power
- High generator winding temperature
- Synchronizing failure
- Cylinder selective Knocking failure

Warning functions e.g.:
- Cooling water temperature min.
- Cooling water pressure min.
- Generator winding temperature max.

Remote signals:
(volt free contacts)

1NO = 1 normally open
1NC = 1 normally closed
1COC = 1 change over contact

• Ready for automatic start (to Master control)	1NO	
• Operation (engine running)	1NO	
• Demand auxiliaries	1NO	
• Collective signal "shut down"	1NC	
• Collective signal "warning"		1NC

External (by others) provided command/status signals:

• Engine demand (from Master control)	1S
• Auxiliaries demanded and released	1S

Single synchronizing Automatic

For automatic synchronizing of the module with the generator circuit breaker to the grid by PLC- technology, integrated within the module control panel.

Consisting of:
- Hardware extension of the programmable control for fully automatic synchronization selection and synchronization of the module and for monitoring of the generator circuit breaker closed signal.
- Lockable synchronization selection via touch screen with the following selection modes:
  - "MANUAL" Manual initiation of synchronization via touch screen button followed by fully automatic synchronization of the module
  - "AUTOMATIC" Automatic module synchronization, after synchronizing release from the module control
  - "OFF" Selection and synchronization disabled
    Control of the generator circuit breaker according to the synchronization mode selected via touch screen.
  - "Generator circuit breaker CLOSED/ Select" Touch-button on DIA.NE XT
  - "Generator circuit breaker OPEN" Touch-button on DIA.NE XT
  - Measurement Generator breaker closing time last synchronization

Status signals:
- Generator circuit breaker closed
- Generator circuit breaker open

Remote signals:
(volt free contacts)
- Generator circuit breaker closed 1 NO

The following reference and status signals must be provided by the switchgear supplier:

- Generator circuit breaker CLOSED 1 NO
- Generator circuit breaker OPEN 1 NO
- Generator circuit breaker READY TO CLOSE 1 NO
- Mains circuit breaker CLOSED 1 NO
- Mains circuit breaker OPEN 1 NO

- Mains voltage via voltage transformers 3x 100 or 120V/v3 - other measuring voltages on request!
- Busbar voltage via voltage transformers 3x 100 or 120V/v3 - other measuring voltages on request!
- Generator voltage via voltage transformers 3x 100 or 120V/v3 - other measuring voltages on request!
- Generator voltage via voltage transformers 3x 100V or 120V/3 homopolar voltage for 59N for medium voltage generators

Voltage transformer in the star/star connection with minimum 50VA and Class 0,5

The following volt free interface-signals will be provided by JENBACHER to be incorporated in switchgear:

- CLOSING/OPENING command for generator circuit breaker (permanent contact) 1 NO + 1 NC
- Signal for circuit breaker undervoltage trip 1 NO

Maximum distance between module control panel and engine/interface panel:	99ft
Maximum distance between module control panel and power panel:	164ft
Maximum distance between module control panel and master control panel:	164ft
Maximum distance between alternator and generator circuit breaker:	99ft

1.11.01 Remote messaging over MODBUS-TCP

Data transfer from the JENBACHER module control system to the customer's on-site central control system via MODBUS TCP using the ETHERNET 10 BASE-T/100BASE-TX protocol TCP/IP.

The JENBACHER module control system operates as a SLAVE unit.
The data transfer via the customer's MASTER must be carried out in cycles.

Data transmitted:
Fault messages, operating messages, measured values (generator power, oil pressure, oil temperature, cooling water pressure, cooling water temperature, etc.) according to JENBACHER standard (interface list).

JENBACHER limit of supply:
RJ45 socket at the interface module in the module control cabinet

1.11.06 Remote Data-Transfer with DIA.NE XT4

General
DIA.NE XT4 offers remote communication using an Ethernet connection.

1.) DIA.NE XT4 HMI
DIA.NE XT4 HMI is the Human-Machine-Interface of DIA.NE XT4 engine control and visualization system for JENBACHER gas engines.
The system offers extensive facilities for commissioning, monitoring, servicing and analysis of the site.
By installation of the DIA.NE XT4 HMI client program it can be used to establish connection to site, if connected to a network and access rights are provided.
The system runs on Microsoft Windows Operating systems (Windows 7, Windows 8, Windows 10)

Function
Functions of the visualization system at the engine control panel can be used remotely. These functions provide control, monitoring, trend indications, alarm management, parameter management, and access to long term data recording. By providing access to multiple systems, also with multiple clients in parallel, additional useful functions are available like

- Multi-user system
- Remote control
- Print and export functions
- Data backup.

The DIA.NE XT4 is available in several languages.

Option - Remote demand/blocking

If the service selectors switch at the module control panel is in position "Automatic" and the demand-selector switch in position "Remote", it is possible to enable (demanded) or disable (demand off) the module with a control button at the DIA.NE XT4 HMI
Note:
With this option, it makes no sense to have an additional clients demand (via hardware or data bus) or a self-guided operation (via JENBACHER master control, grid import /export etc.).

Option - Remote - reset (see TA-No. 1100-0111 chapter 1.7 and 1.9)

Scope of supply

- Software package DIA.NE XT4 HMI Client Setup (Download)
- Number of DIA.NE XT4 HMI - Client user license (Simultaneous right to access of one user to the engine control)

Nr. of license	Access
1	1 Users can be logged in at the same time with a PC (Workplace, control room or at home).
2 - "n" (Optional)	2- "n" Users can be logged in at the same time with a PC (Workplace, control room or at home). If 2- "n" users are locally connected at Computers from office or control room, then it is not possible to log in from home.

Caution! This option includes the DIA.NE XT4 HMI client application and its license only – NO secured, encrypted connection will be provided by JENBACHER! A secured, encrypted connection – which is mandatory – has to be provided by the customer (via LAN connection or customer-side VPN), or can be realized by using option myPlant™.

Customer requirements

- Broad band network connection via Ethernet(100/1000BASE-TX) at RJ45 Connector (ETH1) at DIA.NE XT4 server inside module control panel
- Standard PC with keyboard, mouse or touch and monitor (min. resolution 1024*768)
- Operating system Windows 7, Windows 8, Windows 10
- DirectX 9.0 c compatible or newer 3D display adapter with 64 MB or higher memory

2.) myPlant™

myPlant* is the remote data transfer and diagnostics solution from JENBACHER

	BASIC	CARE	PROFESSIONAL
basic / advanced monitoring			
Liver operating status	✓	✓	✓
Historic and live data trending		✓	✓
Alarm management and notification	Alarm management only	✓	✓
Access to all engine documents	✓	✓	✓
Mobile app	✓	✓	✓
Daily status logbooks	✓	✓	✓
Remote access to engine controller		✓	✓
Fleet management		✓	✓
Engine status notifications (SMS/Email)		✓	✓
increased productivity / strong performance			
Recommended maintenance[1] (coming soon)	✓	✓	✓
Support case management[1]	✓	✓	✓
Predictive maintenance for spark plugs, oil and air filters[2]	Spark plugs lifetime prediction only	✓	✓
Oil & coolant quality monitoring[3]		✓	✓
Fleet emission monitoring[4]	Engine emission monitoring only	✓	✓
artificial intelligence & predictive analytics			
Operator analytics package			✓
Historic performance analysis			✓
User-defined monitoring			✓
On demand: Access to myPlant data via API (Application Programming Interface) service[5]			✓

[1] Available soon for JENBACHER direct markets only
[2] Spark plugs, oil and air filters data might not always be available and is depending on the engine version/type ant the sensors installed
[3] Oil and coolant reports are available in myPlant for the following laboratories: Spectro, JetCare, Polaris, MIC GSM
[4] May require additional hardware installation for emission monitoring (available as upgrade)
[5] Might require development work on customer/service provider side and includes 70 API calls per engine per month

Scope of supply

- Access to myPlant™
- Integration of the plant in the myPlant™ system
- Access to Basic and Care level as per new installation contract
- Access to Professional level via separate contract

Equipment to be provided by the customer

- Permanent Internet connection (wired or wireless)
  (see also option 4)
- Technical requirements as per TA 2300-0008
- Outward data connection (from the plant server to the Internet) - INWARD connections are NOT PERMITTED!

CAUTION: The customer must take technical precautions to ensure that direct access to the plant server from the Internet is prevented (e.g. by means of a firewall):
This security measure CANNOT be assumed and guaranteed by JENBACHER

3.) Mobile Internet (OPTION)
Connection Plant - Customer via secured Internet - connection
See also technical instruction **TA 2300 - 0006**

Scope of delivery

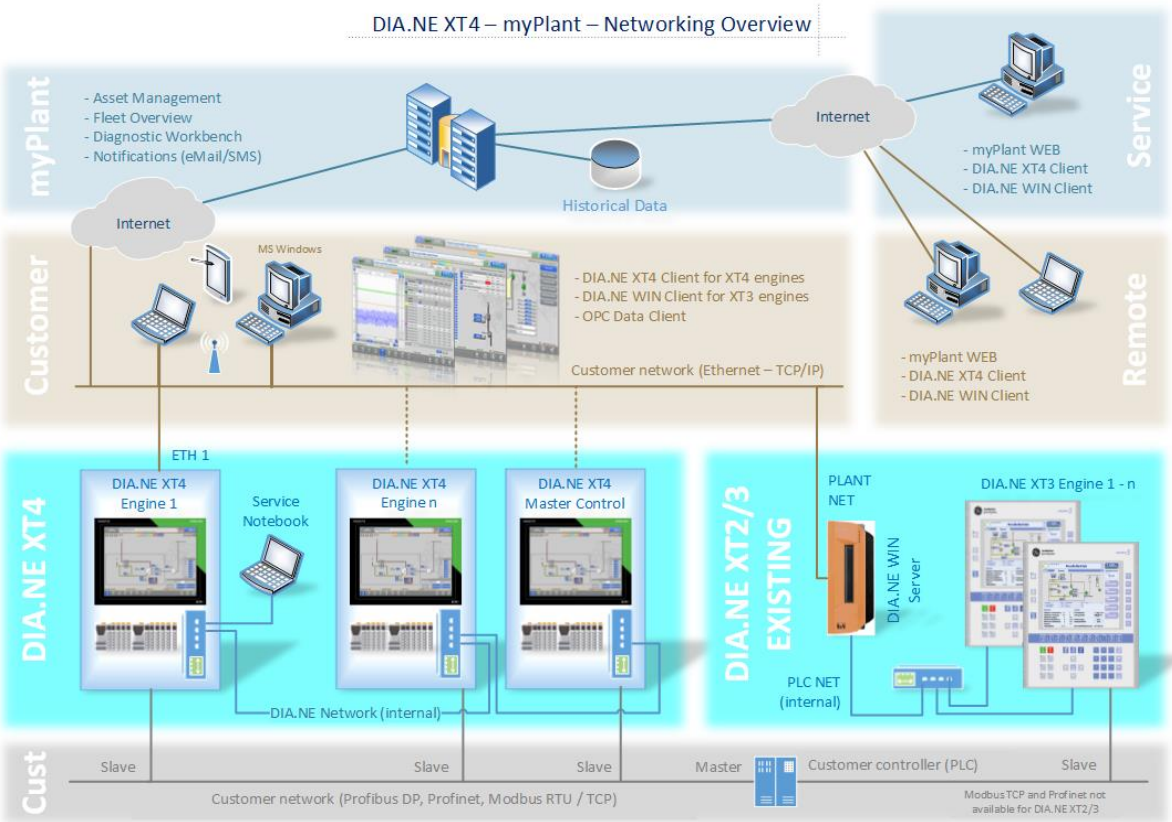
- Mobile Internet router with antenna to connect to the DIA.NE Server XT4

Customer requirements

- SIM card for 3G / 4G

4.) Network overview

For information only!



1.11.10 Active power limitation, Reactive power control per module

Active power limitation:
The module can be operated with a reduced power output if the network operator requires a temporary limitation on feed-in power. Power logging is carried out at the generator terminals.

The customer has the option to engage in module control using the following signals:
- 0/4 - 20mA for the continuous limitation of generator active power from 100 % - 50(PMin) %
- 1 potential-free contact for blocking the module (without RESET function), as Option - in some countries the remotely shutdown of the unit within 5 seconds from receiving the signal can be required for the units of the Type Category A and B eg in Poland

or

- 4 potential-free contacts for the limitation of generator active power from 100 % - 50(PMin) %
- 1 potential-free contact for blocking the module (without RESET function), as Option - in some countries the remotely shutdown of the unit within 5 seconds from receiving the signal can be required for the units of the Type Category A and B e.g. in Poland

Reactive power control:
The reactive power/power factor control point is at the generator terminals

The module is designed for the process of reactive power control described below.
Set point setting via the customer using the following signals:
- 0/4 - 20mA for the continuous cos phi set point setting in the range of xx overexcited to xx under-excited

The following signal is provided to the customer by JENBACHER:
- 0/4 - 20mA for the actual value of generator reactive power
- 0/4 - 20mA for the actual value of generator active power

Further interfaces (or bus interfaces) upon request!

1.11.13 Out-of-step protection / pole slip protection (integrated in DIA.NE XT4)

ANSI Function Code 78

- 3-phase monitoring, integrated in DIA.NE XT4 controller
- Uses voltage measurement at the generator and engine speed measurement (supplied by JENBACHER).
- Allows real-time calculation of rotor angle during dynamic operations
- Allows safe detection of a pole slip risk and allows operation up to the maximum limit value
- Acting on generator circuit breaker and generator de-excitation.
- Alarm message on the DIA.NE screen.
- Active in Grid and Island parallel operation

OPTIONAL on special release:
separate digital protection relay (ATTENTION: different detection as generator and mains voltage are evaluated. Tripping only possible if pole slip has occurred)

Following monitoring are integrated in the DIA.NE generator protection package

- Load angle / pole slip monitoring
- Exciter failure monitoring [ANSI 40]

1.11.14 Generator Overload / Short Circuit Protection

ANSI Function Code 50/51

- Digital protection relay, 3-phase, integrated into the module control panel.
- Connected to the protective current transformers in the generator star point
- Acting on the generator circuit breaker and on the generator de-excitation
- Alarm message on the DIA.NE screen

Characteristics / settings:

- Setting for overload: to 1,1 times of the generating set rated current,
- Dependent time characteristic acc. to IEC 60255-151: very inverse, time multiplier setting 0,6.
- Setting for short circuit: to 2,0 times of generating set rated current,
- Independent time characteristic: 300 ms (800 ms when dynamic network support).

1.11.15 Generator Differential Protection

ANSI function code 87

- Digital protection relay, 3-phase, integrated into the module control panel.
- Connected to the protective current transformers in the generator star point (JENBACHER scope of supply) and to the protective current transformers in the generator circuit breaker panel (current transformers by client, secondary 1A, optionally: 5A).
- Acting on the generator circuit breaker and on the generator de-excitation
- Alarm message identified on the DIA.NE screen

In plants with a unit generator-transformer configuration the protection is realized as generator/transformer differential protection.

1.11.16 Generator Earth Fault Protection (nondirectional)

- Digital protection relay, integrated into the module control panel.
- Acting on the generator circuit breaker and on the generator de-excitation
- Alarm message on the DIA.NE screen

Dependent on the generator grounding method one of the following protection functions is applied:

1) **ANSI function code 50N/G**
   Detection of the earth fault current e.g. by means of a window-type current transformer (Current transformer by client, secondary 1A, optionally: 5A).
2) **ANSI function code 59N/G**
   Detection of the residual voltage e.g. by means of the voltage measured across the broken-delta secondary windings of grounded voltage transformers (voltage transformers by client)

1.11.25 Control Strategy and Options (Mobile)

Unit Additional Features and Options

- *Air Conditioning Unit to be provided for A1+ All-In-One Control Cabinet*
- *Diane XT4 Controls to allow for Customer provided Droop Speed Raise/Lower and Droop Voltage Raise/Lower Control when in Island Mode.*

1.11.25.1 Per Unit Customer Enclosure Controls

Diane XT4 System will be provided with the following additional features to operate a customer enclosure

Option 1C Ventilation Fan control

Discrete IO is provided to demand operation of customer ventilation fans. Start/Stop signals for each fan are provided. It is assumed that the customer MCC will provide starter motor protection and that the customer provides any temperature sequencing and control

Option 3 Audible and Visual Alarm Indications

Hardware and software to drive a customer provided one (1) horn and two (2) strobes. Power for these devices is provided from the control system and is 24VDC

1.11.25.2 Per Unit Balance of Plant Controls

For all following controls only, the panel control parts and software are included. The power supply is in customer scope.

Option 1C Hot Water Return Temperature Control

- This feature will provide all necessary controls to operate Jenbacher loose supplied a 3 Way temperature control valve. . Control and Display Software are also provided.

Option 2A Intercooler Temperature Control

- This feature will provide all necessary controls to operate a Jenbacher loose supplied 3 Way temperature control valve in the IC Loop.. Control and Display Software are also provided.

Option 2B Intercooler Pump Control

- The option will add specific contact output and feedback input to/from an MCC for the Intercooler Water Pump. This will include relays and software.

Option 2C Intercooler Loop Pressure

- This feature will provide a discrete input and associated software for the Intercooler Loop system pressure.

Option 3C Fan Control /Protection/Contacts Data for two circuit radiator

This feature will provide controls for a customer provided dual circuit radiator with up to 16 fans. The fans will be individually controlled based on control valve position. The MCC control signals (DO/DI) will be provided, along with the necessary software.

1.11.25.4 Mains Parallel Control Strategy for single units
Option 1 Grid Parallel with active power (KW) Control

- Real Power Load Control of the Generator set will be either via a 4-20mA input from the customer representing a unit KW load setpoint or a KW load setpoint entered on the Diane XT screen. Upon breaker closure, the unit will ramp to the setpoint at a maximum rate of (Rated Unit KW) / 180 seconds.

Option 2 Grid Parallel with power factor (cos phi) Control

- Reactive Power Load Control of the Generator set will be either via a 4-20mA input from the customer representing a unit Power Factory setpoint or a Power Factor setpoint entered on the Diane XT screen. Upon breaker closure, the unit will maintain the setpoint.

Option 3 Grid Parallel with reactive power Control

- Only possible in single unit use. If there are multiple engines with import / export control on site, a master control is needed
- Reactive power control via an external mA setpoint. Required will be a customer 4-20mA signal representing the site reactive power at the mains connection point. The unit will be controlled to reach the setpoint in either inductive or capacitive control of the generator to a maximum of the preset limitation according offer. When the setpoint is reached, the unit stays on the reactive power, till a change in the measurement or setpoint occurs.

1.11.25.4 Blackout and Island Control Strategy
Option 1 Blackout Start

- The Blackout Starting feature will allow an operator or automation system to start the engine without AC power being present on the plant side of the generator circuit breaker. The customer must ensure that there is sufficient fuel gas and pre-chamber gas at pressure in the event of a Type 6 engine so configured. The engine will start without the normal confirmation of engine block temperature or operation of a circulating AC water pump. It will be required that once the engine is connected to the generator bus that power to the engine auxiliaries be restored. Load Management is expected to be limited by the operators to the limits of the engine, as per JENBACHER TA 2108-0031.
- This feature works for single units only.
- In case of a multiple unit plant blackout operation, a master synchronization is needed to interlock the engines for a black out start and load sharing line. If there is no interlocking system, the engines are prepared for black start, but not released for operation.

Option 5 Grid Parallel with Island Operation (Multiple Unit with customer System)

- While Grid connected, the unit load can be adjusted via its KW control setpoint. In the event of a loss of utility, the unit will be able to continue operating locally without utility power. A separate system must shed load so that the engine is not overloaded, as per JENBACHER TA 2108-0031
- The customer provides an interlocking, load sharing and resynchronization system, the interfaces and additional effort needs to be checked (there is no additional effort for the modules with a JENBACHER Master synchronization)
  - The demand / shut down and control philosophy of the engine is in scope of the customer provided system

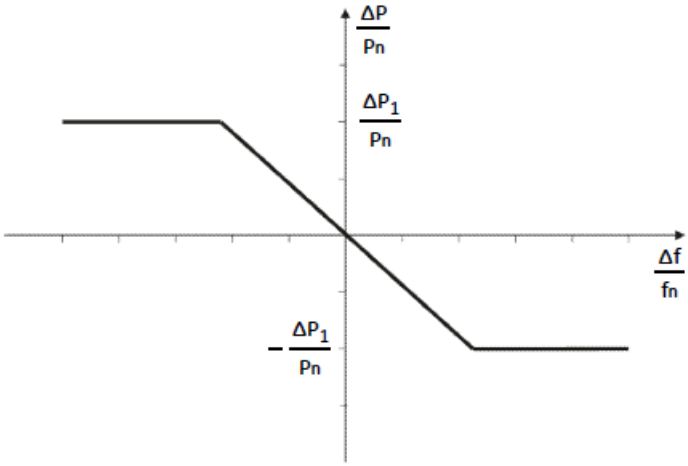
1.11.34 Frequency sensitive control (FSM) -OPTION

The **FSM** function is used to support the stabilization of the frequency around the nominal value by moving the active power operating point when the frequency moves outside a settable dead band.

In case of over frequency, the active power frequency response is limited by the minimum regulating level. (e.g. Pmin 50%)
In case of under frequency, the active power frequency response is limited by the maximum capacity which is available. (e.g. Pn 100%)

The frequency thresholds and the droop settings are specified in the national Grid Codes and/or are specified by the network operator in the connection agreement.
Possible dead band can be set between 0 and 500 mHz

Active power frequency response capability of power-generating modules in **FSM**:



	NC RfG (Article 15)
active power range ΔP1/Pn	1,5 – 10 %
droop Δf/fn : ΔP/Pn [%]	2 - 12 %

1.20.03 Starting system

Starter battery provided by others

Battery voltage monitoring:
Monitoring by PLC.

Battery charging equipment:
2x 3 phase powered, 24VDC, 40A output power supplies capable of charging the starter battery with I/U characteristic and for the supply of all connected D.C. consumers.
Charging device is mounted inside of the module interface panel or module control panel.
See TA 1000-052 for details.

- **General data:**

• Power supply	**3 x 320 - 575 V, 47 - 63 Hz**
• max. power consumption	1040 W / 1550 W (5 sec)
• Nominal D.C. voltage	24 V (+/-1%)
• Voltage setting range	24V to 28V (adjustable)
• Nominal current (max.)	2 x 40 A
• Degree of protection	IP20 to IEC 60529
• Operating temperature	32 °F – 158 °F (0 °C - 70 °C)
• Protection class	1
• Humidity class	3K3, no condensation.
• Natural air convection	
• Standards	EN60950, EN50178 UL/cUL (UL508 / UL 60950-1)

Signalling:
Green Led: Output voltage > 21.6V

Control accumulator:
- Pb battery 24 VDC/18 Ah

1.20.05 Electric jacket water preheating

Installed in the jacket water cooling circuit, consisting of:
- Heating elements
- Water circulating pump

The jacket water temperature of a stopped engine is maintained between 133 °F (56°C) and 140°F (60°C), to allow for immediate loading after engine start.

1.20.08 Flexible connections

Following flexible connections per module are included in the JENBACHER -scope of supply:

No.	Connection	Unit	Dimension	Material
2	Warm water in-/outlet	**in/lbs**	**4"/145**	Stainless steel
1	Exhaust gas outlet	**in/lbs**	**25"/145**	Stainless steel

1 Fuel gas inlet	**in/lbs**	**4"/145** Stainless steel
2 Intercooler in-/outlet	**in/lbs**	**4"/145** Stainless steel
2 Lube oil connection	**in**	**1.1** Hose

Seals and flanges for all flexible connections are included.

2.00 Electrical equipment

Totally enclosed floor mounted sheet steel cubicle with front door wired to terminals. Ready to operate, with cable entry at bottom. Naturally ventilated or with forced ventilation.

Protection:	IP 42 external, NEMA 12 IP 20 internal (protection against direct contact with live parts)

Design according to EN 61439-2 / IEC 61439-2 / UL 508 A and ISO 8528-4.
Ambient temperature 41 - 104 °F (5 - 50 °C), 70 % Relative humidity

Standard painting:	Panel:	RAL 7035
	Pedestal:	RAL 7020 (Rittal TS8) RAL 7020 (Rittal VX25)

2.02 Grid monitoring device Standard 60Hz Profile 1

Standard for generating plants connected to the medium voltage grid with dynamic Grid Code requirements.

Function:
Monitoring device for immediate disconnection of the generator from the grid in case of grid failures.

Consisting of
- Voltage monitoring with two-stage undervoltage and two-stage overvoltage limit function
- Frequency monitoring with underfrequency and over frequency function.
- Separately adjustable, independent times for voltage and frequency monitoring.
- Monitoring of the limit line of the low voltage profile ULVRT
- Display of all measured values for normal operation or malfunction via an alphanumeric display and LEDs.
- Setting authorization through password against unauthorized changes.

Scope of supply:
- Digital grid protection relay with fault data storage, measured value display and self-monitoring.
- Rated input voltages: 100 V / 110 V /400V

Out of standard scope of supply:
- all necessary instrument transformers,
- additional protection equipment acc. to utility operator’s specifications and guidelines.
- Site-specific acceptance test done by approved testing institute

Recommended setting value for Grid monitoring device:
The limit values need to be aligned site-specific with the utility operator!

Parameter	Parameter Limit	Time Delay	Comments
U>> [ANSI 59]	115 %U	0.2 s	Power capability reduction with 1 %Pn/%U above 105 %U
U> [ANSI 59]	111 %U	60 s	Power capability reduction with 1 %Pn/%U above 105 %U
U< [ANSI 27]	80 %U	1.5 s	Power capability reduction with 1 %Pn/%U below 95 %U
U<< [ANSI 27]	45 %U	0.2 s	Power capability reduction with 1 %Pn/%U below 95 %U
f> [ANSI 81O]	62 Hz	0.1 s	Power capability reduction with 10 %Pn/Hz above 61 Hz
f< [ANSI 81U]	57.0 Hz	0.1 s	Power capability reduction within the boundaries of 2 %Pn/Hz below 59 Hz; 10 %Pn/Hz below 59.5 Hz. Default: 10 %Pn/Hz below 59 Hz
Monitoring of the voltage profile U_{LVRT} [ANSI 27T]	28 %U	0 s	For symmetrical faults
	68 %U	0.17 s	
	83 %U	1.6 s	

3.72 Type 6 Engine Options

The following Type 6 additional options are provided:

- Type 6 Humidity Package - The humidity sensor measures the humidity in the intake air and as a first action increases ICWT (if an electrical control valve is installed in the low temperature intercooler circuit) and in case this is not sufficient/possible, power output is reduced

3.73 Type J620 EPA Certification

The J620 engine will carry an EPA Non-Road Mobile Certification provided that, to the extent such certification would require deliveries to be delayed, INNIO or Jenbacher, may provide VoltaGrid proof that each Product has received a temporary exemption for field testing of such units. INNIO shall provide VoltaGrid with all requested documents and correspondence with any regulators or certification agencies to confirm the status of each Product.

3.74 Type J620 Crank Blocking

A crank blocking mechanism is required. Jenbacher will provide a system that will be used for transport that locks the engine/gearbox/generator drive shaft to the genset skid for locking during transport. The 3rd party trailer packager will incorporate a pneumatic control system that will apply air pressure to the locking system during transportation but will release it when the trailer is in parked operation. Indication shall be provided as to whether the system is in locked or disengaged position.

4.00 Delivery, installation and commissioning

4.01 Carriage
According to contract.

4.02 Unloading
Unloading, moving of equipment to point of installation, mounting and adjustment of delivered equipment on intended foundations is not included in JENBACHER scope of supply.

4.03 Assembly and installation
Assembly and installation of all JENBACHER -components is not included in JENBACHER scope of supply.

4.04 Storage
The customer is responsible for secure and appropriate storage of all delivered equipment.

4.05 Start-up and commissioning
Start-up and commissioning with the JENBACHER start-up and commissioning checklist is not included. Plants with island operation require internet connection.

4.07 Emission measurement with exhaust gas analyzer
Emission measurement by JENBACHER personnel, to verify that the guaranteed toxic agent emissions have been achieved (costs for measurement by an independent agency will be an extra charge).

5.01 Limits of delivery - Genset

Electrical:
- Module:
  -
  - At terminals of generator terminal box, must use flexible cable (lugs and glands to be provided locally)
- Module control panel: (All-In-One Cabinet)
  At terminal strips
- Auxiliaries:
  At terminals of equipment which is supplied separately

Mechanical
Bellows and flexible connections **to engine/generator skid are provided to the packager.**.

Cooling water
At inlet and outlet flanges on engine and gearbox

Exhaust gas
At the exhaust gas exit of the engine prior to the gearbox

Combustion air
The air filters are set mounted

Fuel gas
- At inlet and outlet flange of gas train
- At inlet flange of gas pipework on genset
- At outlet flange of the pre-chamber gas train
- At inlet flange of pre-chamber gas pipework on genset
- At connection for boost pressure compensation on genset
- At connection for boost pressure compensation on gas pressure regulator of the pre-chamber gas train

Lube oil
At lube oil connections on genset

Draining connections and pressure relief
Draining connections are to be provided by the 3rd party trailer packager on the basis of Jenbacher provided specifications

Insulation
Insulation of heat exchangers, pipework and exhaust gas silencer is not included in our scope of supply and must be provided locally.

First filling
The first filling of genset, (lube oil, engine jacket water, anti-freeze, anti-corrosive agent) is not included in our scope of supply.

The composition and quality of the used consumables are to be strictly monitored in accordance with the "Technical Instructions" of JENBACHER.

5.02 Factory tests and inspections

The engine and generator shall undergo the following tests and inspections:

5.02.01 Engine tests

Carried out based on ISO 3046-3 at JENBACHER test bench. The following tests are made at 100% load, and the results are reported in a test certificate:

- Engine output
- Fuel consumption
- Jacket water temperatures
- Lube oil pressure
- Lube oil temperatures
- Boost pressure
- Exhaust gas temperatures, for each cylinder

5.02.02 Generator tests

Carried out on the premises of the generator supplier.

5.02.03 Module tests

The engine will be tested based on ISO 8528-6, with natural gas (methane number 94). The performance data achieved at the test bench may therefore vary from the data as defined in the technical specification due to differences in fuel gas quality.The following tests are made and the results are reported in a test certificate:
Visual inspection of scope of supply per specifications.

- Functional tests per technical specification of control system.
  - Starting in manual and automatic mode of operation
  - Power control in manual and automatic mode of operation
  - Function of all safety systems on module
- Measurements at 100% load:
  - Frequency
  - Voltage
  - Current
  - Generator output
  - Power factor
  - Fuel consumption
  - Lube oil pressure
  - Jacket water temperature
  - Boost pressure
  - Mixture temperature
  - Exhaust emission (NOx)

The Pilot Unit is being tested according to Attachment 1.1 Validation Protocol on its designated generator at 60 Hz, 13.8kV and loadbank.
The subsequent genset tests are being performed with a for operating frequenzy 50 Hz and 6,3-6,6kV / 10,5kV-11kV test generator, pre-mounted on a test-frame.
To prove characteristics of the above components, which are not tested on the test bench by JENBACHER, the manufacturers' certificate will be provided.

5.03 Documentation

List of standard pre-documentation provided based on the technical status at the time of order receipt:

- Module drawing **1)**
- Technical diagram **1)**
- Drawings of the cabinet views **3**
- Electrical interface list **2)**
- Technical specification of the control system **2)**

Before delivery (depending on progress in ordering the components, on request)

- Technical drawings for BoP components/accessories supplied separately (if included in scope of supply of INNIO Jenbacher GmbH & Co OG) **1)**

Upon delivery

- Circuit diagrams **3)**
- Cable list **3)**

Delivered with the engine

- Brief instructions (transport, erection, moving) **1)**

For commissioning

- Operation and maintenance instructions **4)**
- Spare parts catalogue **4)**
- Original supplier operation and maintenance instructions for any BoP components (installed in the INNIO Jenbacher GmbH & Co OG scope of supply) as Appendix **1)**

  All the components found in the INNIO Jenbacher GmbH & Co OG scope of supply are described in the operation and maintenance instructions, and in the spare parts catalogue.
  In addition, the manufacturer's original operation and maintenance instructions will be provided for every BoP component, in German and English as standard, as an Appendix for the operation and maintenance manual provided.

  Additional costs of producing or providing the required documents using the KKS (power station coding system) and/or integration in subcontractors' documentation, or additional approval, design and proof of testing documentation must be negotiated or ordered separately.

  This standard offer does not include:

  - Approval documentation
  - Design documentation
  - Proof of testing documentation
  - Printed copies and digital off-line versions (e.g. printed versions, CD, pdf, etc.) must be negotiated separately and ordered accordingly.

Annex TS1 Typical Fuel Gas Constituents

Typical Fuel Gas Constituents Summarized Below:

Gas Specification

Gas Type	Natural Gas MN 70			
Responsible	P&E (Schaumberger)			
Main Gas Content in Vol.-%		**USL**	**Target**	**LSL**
Methane	CH4	93	90	79
Ethane	C2H6	12	1	
Propylene	C3H6	8[1]	7[1]	
Propane	C3H8			
Butane	C4H10	3,5	0,2	
Higher Hydro Carbons	C(5+)H(12+)	1,5		
Hydrogen	H2	1		
Carbon Monoxide	CO			
None CxHy	-			
Inert Component	CO2	2	0,5	
Inert Component	N2	7	2	
Oxygen	O2	0,5		
MN Band (AVL Meth.)		80	70	70
MN Band (MWM Meth.)		79	70	67
Heat Value Hu[2]	kWh/m³	-	11,0	-
Conditions	Gas components related to 0% H2O			
Typical Trace and accompanying elements		**USL**	**Target**	**LSL**
Total Sulphur inkl. H2S	[mg/10kWh]	50	TA 1000-0300	
Main Gas-moisture content	[% rel.]	80	TA 1000-0300	
Pre-chamber Gas-moisture content	[Vol-%]	0,2	TA 1000-0300	
Ammonia NH3	[mg/10kWh]			
Total Chloride	[mg/10kWh]			
Total Fluor	[mg/10kWh]			
Others				
Technical Special Release (TSR)	[yes/no]	No		
	[Before/after offer]			
Remarks	[1]) Merged cells are the sum of the 2 components			
	[2]) Heating value is calculated at 273,15 °C and 1013.25 mbar			
	For Total Silicon and Total Particle Content please refer to TI 1000-0300			

Revision Control

REV 01
230814 – TH – Updated Radiator Data and Cooling Water circuit to 50% Glycol
230821 – AB – Updated scope updates with regards to generator insulation class, flexible coupling, transport frame, All-In-One Control Cabinet, LT and HT 3way valve incl. control and intercooling water pump, coupling guards, starter battery, piping interfaces

REV 02:
012924 – AB - Seismic vibration switch removed

Sim Deshpande

From: Korby Bracken <korby.bracken@voltagrid.com>
Sent: Tuesday, November 18, 2025 12:30 PM
To: Sim Deshpande
Cc: Scott Weaver; Carley Rey; Paige Price
Subject: RE: GC PUD application (VOC emissions difference)

Follow Up Flag: Follow up
Flag Status: Flagged

The uncontrolled should be:

g/hp-hr
NOx: 0.69
CO: 1.31
VOC: 0.13
PM: 0.01
SO2: 0.01
CH2O: 0.20

Korby Bracken, P.E.
Senior Director – Health, Safety & Environment
VoltaGrid LLC

From: Sim Deshpande <SDESHPANDE@ramboll.com>
Sent: Monday, November 17, 2025 4:11 PM
To: Korby Bracken <korby.bracken@voltagrid.com>
Cc: Scott Weaver <msweaver@ramboll.com>; Carley Rey <crey@ramboll.com>; Paige Price <PPRICE@ramboll.com>
Subject: GC PUD application (VOC emissions difference)

Hi Korby –

On the GC PUD application update to the Hug Engineering mobile units, we found a slight issue with the VOC inlet values and the calculated % reduction – see screenshots below:

VOC Inlet = 0.01 g/hp-hr
VOC Outlet = 0.0067 g/hp-hr
Control efficiency = (0.01 – 0.0067)/0.01 = 33%

The calculated CO and HCHO control efficiency is 95% consistent with the other applications we have done. As such, can you confirm that we can simply back-calculate the pre-control VOC numbers by removing the 95% control efficiency from the post control number of 0.0067 g/hp-hr?

2.3. Raw gas emissions

2.3.1 The design and performance guarantee of this offer relies on the following exhaust gas data.

	@ 100% load (J620)	
Exhaust gas temperature	850	°F
Mass flow rate	38, 946	lb/hr (wet)
NOx Nitrogen oxides(as NO2)	<0.69	g/hp-hr
CO	<1.30	g/hp-hr
VOC (NMNEHC)	<0.01	g/hp-hr
Formaldehyde (CH_20)	<0.20	g/hp-hr

2.4.2 Catalytic performance during guaranteed period

CombiKat® skidded SCR systems Pollutants measured downstream the catalytic system:

NOx Nitrogen oxides (as NO_2)	< 0.0138	g/hp-hr
CO	< 0.0653	g/hp-hr
VOC (NMNEHC excluding CH_2O)	< 0.0067	g/hp-hr
Formaldehyde (CH_20)	< 0.0100	g/hp-hr

Kind regards
Sim Deshpande

Senior Managing Consultant

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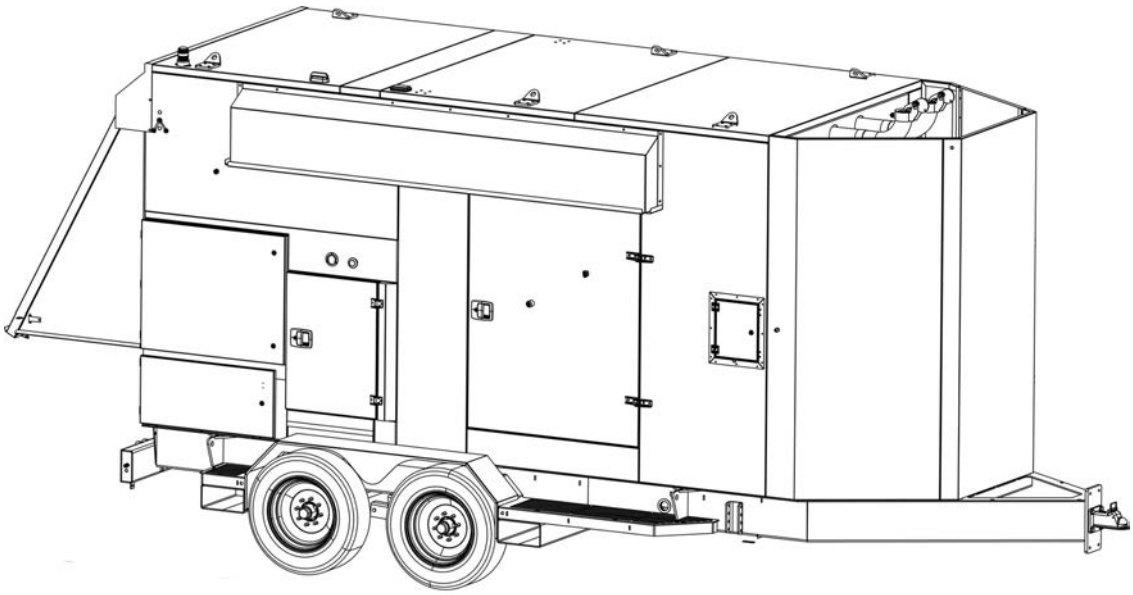
Westford, MA 01886

https://ramboll.com

MESA SOLUTIONS®



Mobile Generator Set

Specifications

Manual Version 1.1
Product Revisions 002, 003
August 2025

Model Numbers Covered by this Manual (Mobile Generator Set)

The final two digits indicate the product's revision number.

A101001-03

A101002-02, A101002-03

A101003-02, A101003-03

A101005-02, A101005-03

A101006-02, A101006-03

A101009-02, A101009-03

A101010-02, A101010-03

A101011-02, A101011-03

A101012-02, A101012-03

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  Engine Information 6
  Alternator Information 8
  Termination Information 8
  Dimensions and Weights 9
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    GV22PU Derate Table 11
Customer Support 12

Version History

Manual Version Number	Description	Reviewed By/ Date	Approved By/Date	Release Date
1.0	Product Revisions 002 & 003	Oji Farrier - 02/21/2025	Andrew Lipe - 02/24/2025	03/07/2025
1.1	Removed model A101007-02 from model number index. **Engine Information** Added "gal" measurement to 'Engine Oil Capacity'. Added "°F" measurement to 'Coolant Operating Temp'. Revised swapped measurements for 'Bore'. Combustion Air Requirement Revised formatting for 'Engine Prime Power' ratings. Removed duplicate 'Coolant Flow Rate (60 Hz)' specification from '60 Hz Engine Specs' table. Removed 'Heat Rejected' rows from '60 Hz Engine Specs' table. Updated wording for 'Fan Speed' - moved location to 'Cooling System' table. Removed duplicate 'Max Fan Power' specification from '60 Hz Engine Specs' table. Exhaust Heat Rejection Rate Exhaust Gas Mass Flow Updated wording for 'Max Exhaust Backpressure' - moved location to 'Exhaust System' table. Added psi measurement for 'Max Exhaust Backpressure'. Updated wording for 'Exhaust Stack Length'. Updated 'Cooling Fan Air Flow (60 Hz)' specification to "35,000cfm (980 m3/min)". Updated 'Max Fan Power (60 Hz)' specification to "46.49 HP (36.47 kW)". Updated 'Max Fuel Supply Pressure' to "60 psi (414 kPA)". Added optimal fuel supply pressure range. Added Minimum Fuel Pressure to EFR specifications at 0.5 kPA). **Alternator Information:** Updated 'Excitation Type" to "Auxiliary Winding, Permanent Magnet". **Dimensions and Weights:** Added note specifying weight type definitions. Revised “Dimension” language in trailer-mounted dimensions table. Updated trailer-mounted weights to reflect wet weights and shipping weights. Added skid-mounted section with images, dimension table, and weight table. **Derates** Added GV22PU Derate Table.	Aaron Carter Shawn Dalke Cross True Rustam Akhmetianov Aubrey Morrison Ethan Rutledge Aurora Bowden Bobby Bryant 08/06/2025	Andrew Lipe - 08/07/2025	08/08/2025

Specifications

Generator Set Information

Electrical Specifications, 60Hz	
Switch Position 1 (480V High Wye)	
Voltage (V)	480/277
Prime Power Rating NG @ 60Hz	390 kWe (488 kVA)
Prime Power Rating LP @ 60Hz	315 kWe (394 kVA)
Power Factor	0.8
Rated Full Load Current	587 A
All Power Ratings Tested per ISO 8528-6:2023 at an elevation of 5,000 ft (1,524 m). Refer to derate table for performance at increased elevation. Due to breaker limitations, PRP (Prime Rated Power) ratings do not include a 10% overload capability.	

Electrical Specifications, 50Hz	
Switch Position 1 (400V High Wye)	
Voltage (V)	400/230
Prime Power Rating NG @ 50Hz	325 kWe (406 kVA)
Prime Power Rating LP @ 50Hz	254 kWe (318 kVA)
Power Factor	0.8
Rated Full Load Current	587 A
All Power Ratings Tested per ISO 8528-6:2023 at an elevation of 5,000 ft (1,524 m). Refer to derate table for performance at increased elevation. Due to breaker limitations, PRP (Prime Rated Power) ratings do not include a 10% overload capability.	

Fuel Consumption (HHV, BTU/hr)	
Fuel Consumption @ 60Hz	
NG Heat Rate @ 100% PRP	4,742,067 BTU/hr
NG Heat Rate @ 75%	3,724,507 BTU/hr
NG Heat Rate @ 50%	2,740,103 BTU/hr
LP Heat Rate @ 100%	3,841,674 BTU/hr
LP Heat Rate @ 75%	3,053,714 BTU/hr
LP Heat Rate @ 50%	2,306,604 BTU/hr
Fuel Consumption @ 50Hz	
NG Heat Rate @100%	4,120,696 BTU/hr
NG Heat Rate @ 75%	3,243,370 BTU/hr
NG Heat Rate @ 50%	2,379,328 BTU/hr
LP Heat Rate @ 100%	3,263,958 BTU/hr
LP Heat Rate @ 75%	2,595,586 BTU/hr
LP Heat Rate @ 50%	1,940,173 BTU/hr
Tested per ISO 8528-5:2022 FUEL SPECIFICATION: Gas properties for fuel consumption data: NG: Density = 0.737 kg/m3, HHV = 1041 Btu/scf (39 MJ/m3); Propane: Density = 1.845 kg/m3, HHV = 2538 Btu/scf (95 MJ/m3); LPG (60-40): Density = 2.060 kg/m3, HHV = 2817 Btu/scf (105 MJ/m3)	

Noise Ratings	
@ 0% PRP	
Average dB @ 1m	88.1
Average dB @ 7m	76.7
@ 100% PRP	
Average dB @ 1m	90.4
Average dB @ 7m	79.8
Tested per ISO 11200	

Control System	
Controller Type	Deep Sea Electronics 8610MKII Generator Set Controller
Remote Start/Stop	Remote Start Capable Through Dry Contact or Modbus
Synchronizing & Load Sharing	Automatic w/ Sync Check
Telemetry & Remote Monitoring	4G and SATCOM Remote Monitoring
Voltage Regulator	Digital, Deep Sea Electronics A109

Engine Information

GV22PU (Prime Rated Power)	
Engine Manufacturer	Mesa Solutions/Hyundai Doosan Infracore
Engine Controller Type	Woodward PG+
Engine Oil Capacity	Min 8.72 gal (33L) - Max 10.65 gal (40L)
Coolant Operating Temperature	Thermostat Cracking at 160 °F (71 °C) Full Open at 185 °F (85 °C)
Radiator Coolant Capacity	21 gal (80 L)
Total Coolant Capacity	51 gal (193 L)
Fuel Quality Limits	NG: 700-1,800 BTU LP: 2,500 BTU
Bore	5.04 in (128 mm)
Direction of Rotation	Counter-Clockwise At Flywheel

Oil System	
Lube Oil Specifications	SAE 15W-40 Low Ash Gas Engine Oil (.25 - .5% by wt), API CD/CF or Higher
Engine Oil Capacity	10.65 gal (40 L)
Day Tank Oil Capacity	26 gal (98 L)
Total Oil Capacity	36.65 gal (139 L)

Exhaust System	
Exhaust Stack - Single/Dual	Dual
Exhaust Stack Length	120 in (305 cm)
Exhaust Stack Diameter	4 in (10.2 cm)
Max Exhaust Backpressure	2.18 psi (15 kPA)
Exhaust Gas Temp, Max (Pre-Catalyst)	1,202 °F (650 °C)

Cooling System	
Coolant Specifications	Havoline Universal Antifreeze/Coolant - Premixed 50/50
Engine Coolant Capacity	14 gal (53 L)
Coolant Flow Rate	165 gal/min (625 L/min)
Cooling Fan Air Flow	35,000 cfm (980 m3/min)
Fan Speed	1,720 RPM
Fan Power	46.49 hp (36.47 kW)

Emissions Control	
AFR Controller	Yes, w/ No Customer Interface
NSCR Catalyst	Yes
Emissions Certification	EPA Certification

Fuel System	
Fuel Type(s)	Natural Gas, Propane (HD5)
Fuel Water Content	Acceptable: Saturated Fuel Not Acceptable: Water Condensation in Fuel Lines/Engine
Fuel Supply Connection(s)	NG: 2" NPT Female LP: #6 SAE Male
Min Fuel Supply Pressure	8 psi (55 kPA)
Max Fuel Supply Pressure	60 psi (414 kPA)
 **NOTE** The ideal fuel supply pressure for optimal system performance is between 20 psi (138 kPA) and 50 psi (345 kPA).	
Natural Gas Engine Fuel Pressure to EFR	
Min Rated Load Max Rated Load	2 inWC (0.5 kPA) 18 inWC (4.5 kPA)
Liquid Propane Engine Fuel Pressure to EFR	
Min Rated Load Max Rated Load	2 inWC (0.5 kPA) 16 inWC (4 kPA)

Battery	
Voltage	12 V
Group Size	31
Cold Cranking Amps	950 A
Required Quantity	2
Connection	Series (24 V)

Notes	
1	Cooling fan specifications are for 110 °F at radiator, 1000 ft elevation, and 60 Hz.
2	All values in the following section are for informational purposes only and are non-binding.
3	Production tolerances account for power variations ± 5%. Altitude, temperature, and gas quality derates may need to be applied.
4	For any temperature above the rated maximum manifold air temperature, please refer to the manifold air temperature derate table.
5	Natural gas testing was performed with pipeline quality natural gas.
6	Mechanical Power Rating (kWm) does not account for fan or generator set losses.
7	RPM Ranges are as defined by ISO 8528-5:2018.

Alternator Information

Alternator (General)	
Alternator Manufacturer	WEG
Alternator Model	AG10-280MN70AI
Alternator Phase	3-phase
Insulation Class	H
Stator Winding	2/3 Pitch
Temp. Rise/Ambient	125/104 °F (40 °C)
Alternator Style	Single Bearing, Weatherproof, IP23
Excitation Type	Brushless, Auxiliary Coil (iPMG)
Coupling System	Close Coupled, Flex Plate
Overspeed Capability	2,250 RPM
PF at rated kW	0.8 PF
Alternator Real Power Rating	456 kWe
Alternator Apparent Power Rating	570 kVA

Termination Information

Camlock			
	L1/L2/L3	N	G
Ampacity	400 A	400 A	400 A
Quantity	3	3	3
Polarity	Female		

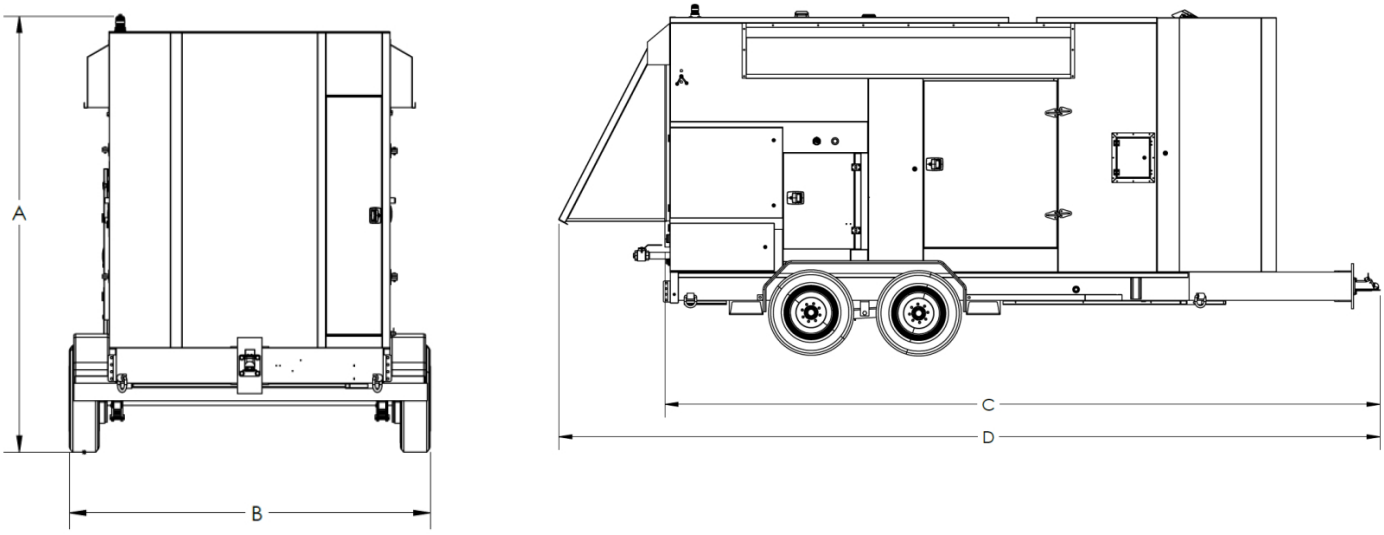
Mechanical Lug			
	L1/L2/L3	N	G
Connections	4	4	4
Conductor Range	2AWG-600MCM	2AWG-600MCM	2AWG-600MCM
Tightening Torque	375 in-lb (42 Nm)		

Dimensions and Weights

NOTE
Mesa Wet Weight - Total weight of fully assembled generator, including all fluids.

Mesa Shipping Weight - Total weight of fully assembled generator, including all fluids (except day tank oil).

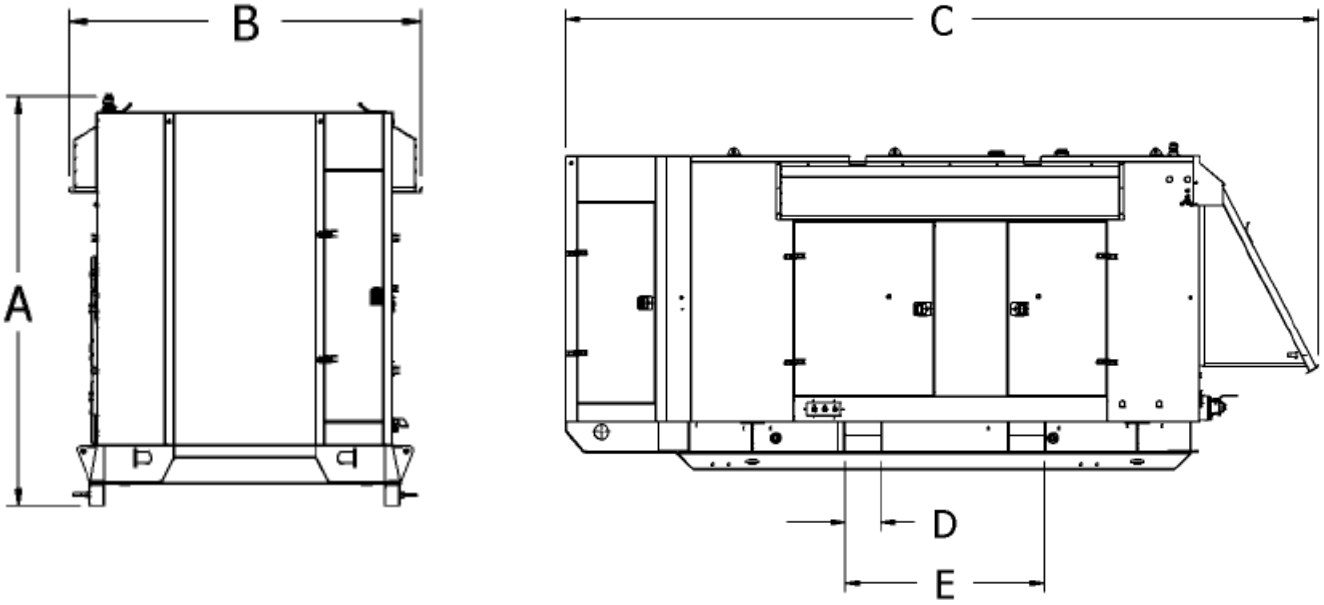
Trailer-Mounted



Dimension "A"	Dimension "B"	Dimension "C"	Dimension "D"
124 in (315 cm)	103 in (262 cm)	260 in (660 cm)	291 in (739 cm)

Revision Number	Mesa Wet Weight	Mesa Shipping Weight
Rev 002	15,714 lb (7,128 kg)	15,516 lb (7,038 kg)
Rev 003	15,732 lb (7,136 kg)	15,534 lb (7,046 kg)

Skid-Mounted



Dimension "A"	Dimension "B"	Dimension "C"	Dimension "D"	Dimension "E"
111 in (282 cm)	96 in (242 cm)	255 in (648 cm)	12 in (30 cm)	68 in (172 cm)

Revision Number	Mesa Wet Weight	Mesa Shipping Weight
Rev 002	14,558 lb (6,603 kg)	14,360 lb (6,514 kg)
Rev 003	14,567 lb (6,607 kg)	14,378 lb (6,522 kg)

Derates

GV22PU Derate Table

GV22PU Derate Table							
Altitude (m)	**Temp (°C)**						
	0	10	20	25	30	40	50
	Engine Derate Power Multiplier (Power Output = Multiplier X Rated Power)						
0	1.00	1.00	1.00	1.00	1.00	1.00	0.98
100	1.00	1.00	1.00	1.00	1.00	1.00	0.98
200	1.00	1.00	1.00	1.00	1.00	1.00	0.98
300	1.00	1.00	1.00	1.00	1.00	1.00	0.98
400	1.00	1.00	1.00	1.00	1.00	1.00	0.98
500	1.00	1.00	1.00	1.00	1.00	1.00	0.98
600	1.00	1.00	1.00	1.00	1.00	1.00	0.98
700	1.00	1.00	1.00	1.00	1.00	1.00	0.97
800	1.00	1.00	1.00	1.00	1.00	0.99	0.96
900	1.00	1.00	1.00	1.00	0.99	0.98	0.95
1000	0.99	0.99	0.99	0.99	0.98	0.97	0.94
1100	0.98	0.98	0.98	0.98	0.97	0.96	0.93
1200	0.97	0.97	0.97	0.97	0.96	0.95	0.92
1300	0.96	0.96	0.96	0.96	0.95	0.94	0.91
1400	0.95	0.95	0.95	0.95	0.94	0.93	0.90
1500	0.94	0.94	0.94	0.94	0.93	0.92	0.89
1600	0.93	0.93	0.93	0.93	0.92	0.91	0.88
1700	0.92	0.92	0.92	0.92	0.91	0.90	0.87
1800	0.91	0.91	0.91	0.91	0.90	0.89	0.86
1900	0.90	0.90	0.90	0.90	0.89	0.88	0.85
2000	0.89	0.89	0.89	0.89	0.88	0.87	0.84
2100	0.88	0.88	0.88	0.88	0.87	0.86	0.83
2200	0.87	0.87	0.87	0.87	0.86	0.85	0.82
2300	0.86	0.86	0.86	0.86	0.85	0.84	0.81
2400	0.85	0.85	0.85	0.85	0.84	0.83	0.80
2500	0.84	0.84	0.84	0.84	0.83	0.82	0.79
2600	0.83	0.83	0.83	0.83	0.82	0.81	0.78
2700	0.82	0.82	0.82	0.82	0.81	0.80	0.77
2800	0.81	0.81	0.81	0.81	0.80	0.79	0.76
2900	0.80	0.80	0.80	0.80	0.79	0.78	0.75
3000	0.79	0.79	0.79	0.79	0.78	0.77	0.74

Customer Support

For customer support, contact Mesa Natural Gas Solutions.

Mesa Natural Gas Solutions, LLC
6392 Byrd Drive
Loveland, CO 80538

Toll free: 844-247-MESA (6372)
www.mesangs.com

GV22PU Zero-Hour Emissions (NG)

EPA Family: SMSAB22.0V22 (2025)						
Test Conditions: 60Hz, 10.5in Mesa Catalysts, Pipeline NG Emergency Standby Power[1]: 510 kWm						
Brake Specific Emissions	Natural Gas					
	Uncontrolled[5]		Controlled		Catalyst Efficiency	
	(g/kW-hr)		(g/kW-hr)		%	
	D2	D1	D2	D1	D2	D1
NO_x	19.92	19.19	0.068	0.112	99.9	99.9
NMHC[2]	0.363	0.214	0.079	0.053	99.8	99.8
CO	17.30	14.35	0.020	0.027	99.9	99.9
CO_2	645.6	585.5	725.9	640.6	98.9	98.9
N_2O	0.007	0.005	0.043	0.053	93.9	89.4
NO_x + THC	22.23	20.61	1.263	0.911	99.9	99.9
NO_x + NMHC	20.29	19.40	0.148	0.165	99.9	99.9
THC	2.305	1.423	1.195	0.799	99.5	99.4
CH_4	1.942	1.209	1.116	0.746	99.4	99.4
BSFC[3]	248.0	223.5	266.2	234.7	98.9	98.9

NOTES:

(1) Mechanical power rating does not account for alternator efficiency or fan losses.
(2) NMHC is used in place of VOC for this report.
(3) BSFC is the weighted composite fuel consumption over the emission cycle.
(4) D2 and D1 are weighted composite emissions test cycles from ISO 8178.
(5) All values in this section are for information purposes and are non-binding.

GV22PU Zero-Hour Emissions (NG)

EPA Family: SMSAB22.0V22 (2025)						
Test Conditions: 60Hz, 10.5in Mesa Catalysts, Pipeline NG Emergency Standby Power[1]: 684 hp						
Brake Specific Emissions	Natural Gas					
	Uncontrolled[5]		Controlled		Catalyst Efficiency	
	(g/hp-hr)		(g/hp-hr)		%	
	D2	D1	D2	D1	D2	D1
NO_x	14.86	14.308	0.051	0.084	99.9	99.9
NMHC[2]	0.271	0.160	0.059	0.040	99.8	99.8
CO	12.90	10.70	0.015	0.020	99.9	99.9
CO_2	481.4	436.6	541.3	477.7	98.9	98.9
N_2O	0.005	0.004	0.032	0.040	93.9	89.4
NO_x + THC	16.58	15.37	0.942	0.679	99.9	99.9
NO_x + NMHC	15.13	14.47	0.110	0.123	99.9	99.9
THC	1.719	1.061	0.891	0.596	99.5	99.4
CH_4	1.448	0.902	0.832	0.556	99.4	99.4
BSFC[3]	184.9	166.7	198.5	175.0	98.9	98.9

NOTES:

(1) Mechanical power rating does not account for alternator efficiency or fan losses.
(2) NMHC is used in place of VOC for this report.
(3) BSFC is the weighted composite fuel consumption over the emission cycle.
(4) D2 and D1 are weighted composite emissions test cycles from ISO 8178.
(5) All values in this section are for information purposes and are non-binding.

GV22PU Zero-Hour Emissions (LP)

EPA Family: SMSAB22.0V22 (2025)				
Test Conditions: 60Hz, 10.5in Mesa Catalysts, LP Emergency Standby Power[1]: 420 kWm (563hp)				
Brake Specific Emissions	LP			
	Controlled			
	(g/kW-hr)		(g/hp-hr)	
	D2	D1	D2	D1
NO_x	0.088	0.131	0.066	0.098
NMHC[2]	0.069	0.043	0.051	0.032
CO	0.037	0.045	0.028	0.034
CO_2	892.2	782.4	665.3	583.4
N_2O	0.139	0.138	0.104	0.103
NO_x + THC	0.219	0.219	0.163	0.163
NO_x + NMHC	0.157	0.173	0.117	0.129
THC	0.131	0.089	0.098	0.066
CH_4	0.062	0.046	0.046	0.034
BSFC[3]	298.5	261.7	222.6	195.1

NOTES:

(1) Mechanical power rating does not account for alternator efficiency or fan losses.
(2) NMHC is used in place of VOC for this report.
(3) BSFC is the weighted composite fuel consumption over the emission cycle.
(4) D2 and D1 are weighted composite emissions test cycles from ISO 8178.
(5) All values in this section are for information purposes and are non-binding.

APPENDIX E
BACT TABLES

Table 1
Select Emission Factors from USEPA's RACT/BACT/LAER Clearinghouse for Large Natural Gas Fired Generators (>500 HP)
VoltaGrid, LLC
Quincy, Washington

RBLC ID	State	Process Description	Permit Date	Size	Pollutant	Type of Control Technology	BACT Limit(s)
IN-0394	IN	Gen 1 through Gen 4	7/5/2024	2,242 hp	NO_x	Lean burn technology with good combustion practices, use of natural gas only	0.50 g/bhp-hr
MI-0459	MI	FG_ENGINES	6/27/2024	29,147 bhp	CO_2e	Good combustion practices, use of current energy efficiency measures	90,268 tons/year
					CO	Catalytic oxidation, good combustion practices	0.30 g/bhp-hr
					NO_x	Selective catalytic reduction, lean burn combustion	0.50 g/bhp-hr
					PM, filterable	Good combustion practices	2.0 lb/hr
					PM_{10}	Good combustion practices	4.0 lb/hr
					$PM_{2.5}$	Good combustion practices	4.0 lb/hr
					VOC	Catalytic oxidation, good combustion practices	0.70 g/bhp-hr
WI-0314	WI	Reciprocating Internal Combustion Engine (RICE)(P101-P107)	3/10/2022	25,850 hp	CO_2e	Use of good combustion practices and use of pipeline quality natural gas	1,100.0 lb/MWh
					CO	Use of good combustion practices and use of oxidation catalyst	4.43 lb/hr
					TPM	Use of good combustion practices and use of pipeline quality natural gas	2.37 lb/hr
					PM_{10}	Use of good combustion practices and use of pipeline quality natural gas	2.37 lb/hr
					$PM_{2.5}$	Use of good combustion practices and use of pipeline quality natural gas	2.37 lb/hr
					Visible emissions	Use of good combustion practices and use of pipeline quality natural gas	5% opacity
					VOC	Use of good combustion practices and use of oxidation catalyst	4.49 lb/hr
MI-0440	MI	FGENGINES	5/22/2019	16,500 hp	CO_2e	Utilize low-carbon fuels and implement energy efficiency measures and preventative maintenance pursuant to manufacturer recommendations	48,724 tons/year
					CO	Oxidation catalyst	0.30 g/bhp-hr
					NO_x	Selective catalytic reduction	0.50 g/bhp-hr
					PM, filterable	Natural gas and good combustion practices	2.0 lb/hr
					PM_{10}	Natural gas and good combustion practices	3.0 lb/hr
					$PM_{2.5}$	Natural gas and good combustion practices	3.0 lb/hr
					VOC	Oxidation catalyst	0.70 g/bhp-hr
KS-0030	KS	Spark ignition RICE electricity generating units (EGUs)	3/31/2016	13,410 hp	CO_2e	--	10,692 tons/year
					CO	--	1.25 lb/kWh
					NO_x	--	2.13 lb/hr
					PM	--	1.31 lb/hr
					PM_{10}	--	1.31 lb/hr
					$PM_{2.5}$	--	1.31 lb/hr
					VOC	--	5.82 lb/hr

Table 1
Select Emission Factors from USEPA's RACT/BACT/LAER Clearinghouse for Large Natural Gas Fired Generators (>500 HP)
VoltaGrid, LLC
Quincy, Washington

RBLC ID	State	Process Description	Permit Date	Size	Pollutant	Type of Control Technology	BACT Limit(s)
LA-0292	LA	Waukesha 16V-275GL Compressor Engines Nos. 1-12	1/22/2016	5,000 hp	CO_2e	--	21,170 tons/year
					NO_x	Lean-burn combustion, use of natural gas as fuel, good equipment design, and proper combustion techniques	0.45 g/bhp-hr
					$PM_{2.5}$	Use of natural gas as fuel, good equipment design, and proper combustion techniques	0.003 lb/hr
					VOC	CO oxidation catalyst, use of natural gas as fuel, good equipment design, and proper combustion techniques	0.113 g/bhp-hr

Abbreviations:

BACT - Best Available Control Technology
bhp - brake horsepower
CO - carbon monoxide
CO_2e- carbon dioxide equivalents
g/bhp-hr - grams per brake horsepower hour
hp - horsepower
lbs/hr - pounds per hour
lbs/MWh - pounds per megawatt hour
NO_X - nitrogen oxides
PM_{10} - particulate matter less than 10 microns in diameter
$PM_{2.5}$ - particulate matter less than 2.5 microns in diameter
PM - particulate matter
PSD - Prevention of Significant Deterioration
VOC - volatile organic compound

Table 2
Presumptive t-BACT for Ammonia Slip from Selective Catalytic Reduction
VoltaGrid, LLC
Quincy, Washington

Application Number	Jurisdiction	Process Description	Permit Date	Size	Pollutant	Basis of BACT/LAER Determination	Limit
613081	South Coast Air Quality Management District	Selective Catalytic Reduction (SCR) emission control system with urea injection for prime natural gas fired electrical generation lean-burn engine	9/2/2022	1,573 hp	NH_3	Achieved in Practice/New Technology	10 ppm

Abbreviations:

hp - horsepower
LAER - Lowest Achievable Emission Rate
MW - megawatt
NH_3 - ammonia
ppm - parts per million
SCR - selective catalytic redution
t-BACT - Toxics Best Available Control Technology

APPENDIX F
AIR DISPERSION MODELING FILES
(SUBMITTED ELECTRONICALLY TO ECOLOGY)